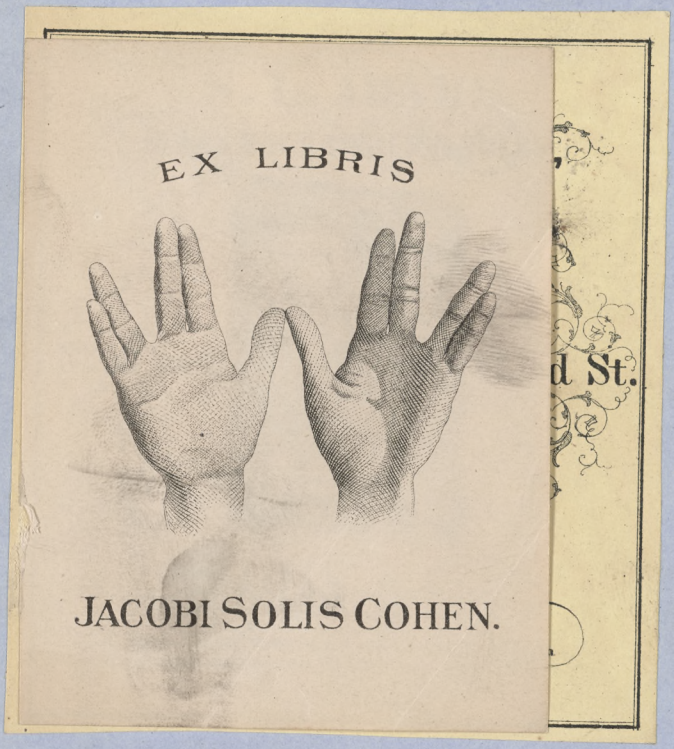
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JACOBI SOLIS COHEN.

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Notes of J. Solis Cohen
on Lectures of
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Institutes of Medicine

Our study at present is Physiology, often called Biology owing to the functions of animals & vegitables. Biology is the point to which our attention is directed & requires other branches for its application. Chemistry gives more aid than any other phenomenon. Physics aids us likewise. We also invoke Sciology, the Science & doctrine of the mind.

[II] Elements are divided into 2 great classes. Inorganic & Organic Inorganic matter has no functions & is not provided with organs and instruments. We must find out the body before we investigate the functions exerted by its organs. A living body must be born, nourished & reproduced & they must truly die. A body must be reproduced before it is born. One essential principle of life is

The organic elements consist of 4: An Inorganic body dies from being subjected to violence & some chemical action

The Inorganic Elements are 3. We have Vegitable organic elements: In animal substance we have properties which belong to vegitables. Chemistry does not point out the exact difference between Animal & Vegitable Substances.

Both animals & vegitables must be reproduced & have the functions of reproduction, & should be classed under the organic functions. After being digested matter is absorbed & then sent in the living animal into the lungs & is respired. In vegitable matter the under part of the leaf is the respiratory organ; circulation is the next change & exists in both orders; then the organs of ~~excretion~~ Secretion which are in the vegitable as well as in the animal The organs of Nutrition exist in both, as also the power of forming heat which Enables man to resist the coldest temperatures. We have also organs which distinguish the animal from the vegitable & enable man to reason & judge; the nerve matter which belongs essentially to the animal, which we call organs & which consist of the organs of Sensation intellection & motion

Inorganic elements { Oxygen, Hydrogen, Carbon, Nitrogen } always present

2 Organic elements { Fibrine, Albumine, Caseine, &c

Vegetation { organs of Organic { digestion, absorption, respiration, circulation, Secretion, nutrition, Calorification

Animal { organs of { Secretion, Intellection, Motion

A living body is born, nourished, reproduced & dies.

[illegible] The human body has been found to be composed of Solids & fluids. The Solids can be reduced down to one simple tissue. The amount of fluid has been estimated to be 9 times as great as that of the Solid, for a body weighing 120 lbs, having been dried was found to weigh only 10 lbs, Some physicians have Contended that all disease is seated in the Solids; & others that all disease is found in the fluids. Now, it is generally admitted that all organic disease is seated in the Solids. The Solids of the body alone are possessed of vital force, & there is no vital force in the blood. The blood vessels are pipes distributing blood to the living Solid which will lead it to the proper part & mix it up into tissue. There can be no primary fibre which can form up all the tissues of the body. It is thought that all tissues can be reduced to cells, each cell endowed with different properties, each cell being different, different cells being united together to form different tissues, & by a union of these tissues to form the body. There may be fibres having a living force in them & entering into them, materials for their nutrition, & they may be continually casting off those materials which are no more of use. Every one of the Solids are formed thus 1st Granules or molecules. 2 nuclei or cytoblasts 3 cells, primary

4 Filaments or fibrils 5 Fibres [tissues] 6. Organs. 7. Apparatuses.
These are the constituents of Solids, found by Analysis. All the tissues of the body are formed from cells. If rounded or flattened cells come in contact with each other, you will have in the one case a membrane, & in the other taking away the walls, a vessel. Every solid of the body is composed of cells having different endowments. The arrangement of tissues is very difficult. The primary tissues are 1st the Areolar, 2nd the Muscular 3d the Nervous. The 1st is composed of Gelatin, the 2d of Fibrin & the 3d of Phosphurretted fat & Albumen. The Areolar tissue is composed of fibres running very irregularly having a ready communication with each other. The origin & insertion of muscles are formed of areolar tissue, but the bodies are formed of Fibrin. There is an effort produced on the Areolar tissue by a mechanical or chemical stimulant. From the arrangement of the primary with other tissues we form the different arrangements which go to the formation of the body. The thinnest membrane consists of several tissues & not of a single one. The bladder is composed of three membranes, the mucous, muscular & peritoneal coat.

IV. Organized tissue has physical properties. The tendons of muscles are flexible, but not expansible. If they were expansible, the power exerted by the muscle in its Contraction would be lost before it was applied. Elasticity is called into existence in any living object, whether living or dead. It give rise to the generation of a new power. Animal substances when put in the fire, curl up & Can thus be distinguished from vegitables. All substances are possessed of the power of parting with the moisture they Contain, and of obtaining from the atmosphere under other circumstances part of its moisture. This is a hygrometric power. We can often invoke its aid in pathology & in remedies. Here is another power Some substances have of imbibing materials that are placed in contact with it; this applies also to gases & respiration is only an action of gases. In these Cases there is an affinity between the fluid & the Capillary tubes or pores of a body. This is a Case of Simple imbibition. Endosmose is that property by which a fluid in Contact with an animal membrane will pass through it, to mix itself with another kind of fluid on the other Side of the membrane. Exosmose is exactly the Contrary. The degree of Capillary ascension is measured by the affinity the fluid has to the Sides of the tubes up which

it ascends. Fluids of less density will ascend higher than others. Endosmose is different with different fluids & with different membranes; & the inference that the character of the Septum has much to do with the Capillary passage of different fluids.

V Capillary ascension

	Tubes filled respectively with		
Immersed in	sand	pounded glass	Sawdust
alcohol	85m	175	185
water	175	182	60

The above experiment was performed to prove the amount of affinity between different liquids & different substances.

Many medicines are said to act by Endosmose. The various forms of dropsy belong to the action of Endosmose. There is a different action in membranes possessed of vitality & in those from which their vitality is gone. The distinction between a living & a dead membrane is a vital force present in the one & absent in the other.

VI There is a power in living tissue of appreciating some kind of irritant & of moving responsive to that irritant. The same tissue may not move alike when different irritants are applied to it. There is only one kind of distinction on the part of all tissues: irritability is the property possessed by every living tissue, be it animal a best vegitable

There is an impressed Sympathy or consent between the different tissues possessed of irritability. Irritation takes place between all the different parts of the body with great rapidity. There are various forms of Sympathy. 1st Continuous Sympathy, or Sympathy of Continuity. There is a Sympathy of Continuity existing in the intestinal Canal 2nd. There is Sympathy of Contiguity; where the parts are near each other, as in the Case of the application of Emmenagogues, every one of which is an indirect agent. This Sympathy is invoked by the physician in a vast number of Cases. 3rd There is the remote Sympathy; where there is no Continuity or Contiguity; & where the irritation is produced in one part of the economy & another part is affected by it, without our understanding the Cause. This is exemplified in the Case of the bite of a mad dog. We have sometimes Sympathy existing the tissues in disease, which it does not excite in health. The agent concerned in this Sympathy is Considered generally to be the nervous System. But I think this is not necessarily Called in action in all Cases of Sympathy. There is a kind of vibration produced in one part which may by virtue of its vital force extend along the membrane so that another part may be affected. This exists in Cases of Continuity & Contiguity; but in remote Cases, the irritation is referred to the Nervous System & then reflected

back to the part affected. We must enquire concerning the number of organs in the body, & after that the number of functions which we can refer to the distinct organs. Wherever there is an organ or series of organs there must be some distinct functions referred to them. My arrangement of functions is as follows.

- Functions
  - relating to the preservation of the
    - Individual
      - Nutritive
        - Digestion
        - Absorption
        - Respiration
        - Circulation
        - Nutrition
        - Secretion
        - Calorification
      - Animal
        - Sensation
        - Intellection
        - Muscular Motion
    - Of the Species — reproduction — generation

VII Digestion belongs to all organized bodies but more to the animal than the vegitable. The animal must move about to search his food & must have a receivir to Carry it to him in which to place his food, he must have the knowledge of what materials serve him for food & he must have muscular motion to be able to lay hold of & apply those substances necessary for his Constitution. Every organized body must have some Carbonic Acid. There are only 5 parts of carbonic acid in Each 1000, Every plant an

support to exist on the earth lives by the Carbon in the atmosphere. The green surface of the earth decomposes the Carbonic acid in the atmosphere, which comes in Contact with the rootlets of the plant, & becomes also Condensed in the Soil. Some Soils Contain more than others. Porous Soils absorb more Carbonic acid than others & may be produced by the application of Gypsum. Ammonia is more or less present in the atmosphere & becomes condensed in the porous Soils. We have in the Soil water which Contains hydrogen & Oxygen & we have in the Soil the four inorganic Elements, Carbon Oxygen, hydrogen & nitrogen, ready to pass in the internal portion of the plant. Certain acts of digestion in the Animal have their analogue in the digestion of the plant. At the extremities of the rootlet is an expansion Called the Spongiola analagous to the duodenal all which forms Animal Substance. They have water, Carbonic acid & Ammonia in Contact with them. The water passes through by Endosmose gets in the interior of the plant & forms Crude Sap which is formed by absorption a kind of digestion. In the lower animals the reception of food is not more elevated than in the case of the plants. It has been said each animal has a reservoir for the reception of its alimentary matter which distinguishes it from a vegetable. There is no such canal in the simple monad, or in the hydra, which has a cavity with one opening & can be turned inside out without much damage

In the structure of the animalcules you discover something the type of an intestinal canal, the characteristic of the Animal creation, & this is the smallest type of the digestive organs. The long mucous membrane is a continuation of the common integument & these animals may be inverted & dont seem to suffer much from it. External absorption takes place from the external surface of the body or from the mucous membranes which are only a prolongation of the external tissue. Therefore aliment is never in contact with the body. All alimentary matter must have belonged to the organized kingdoms & there are many inorganic bodies which enter in the formation of man, yet they must be acquired something in the manner of aliment; though they are not capable of forming tissue, yet they add materially in their formation, & their presence is necessary for the perfect formation of certain tissues. There are therefore substantive aliments & also adjective aliments. The first go to the formation of tissue & the other assist in the digestive functions. An adjective aliment is a Condiment, & put the digestive functions in a condition to obtain a larger amount of nutritive matter than would be obtained otherwise. The form of food which yields the greatest amount of alimentary matter are those which belong to the organic kingdom. All animal food is essentially nitrogenized, & all the essential parts of vegitables. Other food may be animal & not

nitrogenized, or have saccharine food & oleaginous food.

VIII. Aliments Can be divided into two classes Nitrogenized & Non nitrogenized. The nitrogenized aliments go to form tissue, & the non nitrogenized are only Elements for respiration & form heat or Calorification. This is a view I can never Embrace. I think the non nitrogenized, Can be Converted into nitrogenized aliments, & go nearly as much to the formation of tissue. The Non nitrogenized Substance surrounds the nitrogenized & is Converted into nitrogenized in the formation of a new being in a fecundating Copulation there is a nucleated Cell which is essentially nitrogenized. It is on this principle we give Cod liver oil or Non nitrogenized matter in those diseases in which there are nucleated Cells, in Scrofulous or tuberculous. Many chemists have Contended that gelatine is not a nitrogenised aliment & therefore unfit for the formation of tissue, because it Cannot be reduced to protein, as fibrin albumen, & Caseine Can, although their own analysis proves that it Contains more nitrogen than albumen does, the only difference between which & gelatine is that the latter is devoid of white the albumen Contains a small quantity of Sulphur & phosphorus as the analysis on the opposite page will shew. When individuals have been accustomed to different Kinds of diet, & are restricted to one Kind of diet, be it what it may, there will be a falling off of

nutrition which proves Man is essentially an omnivorous Animal. In plenary health it is necessary to have a mixture of Animal food & vegitable food & where a person has from some cause been restricted to one kind of animal food, a change of the Animal food will produce beneficial results.

Arrangement of Aliments

1. Nitrogenized called (Albuminous)
   - Fibrinous (glutinous)
   - Albuminous
   - Caseinous
   - Gelatinous

2. Non Nitrogenized
   - Amylaceous
   - Saccharine
   - Oleaginous

	Albumen	Gelatine
Carbon	54.84	50.048
Hydrogen	7.09	6.643
Nitrogen	15.83	18.338
Oxygen	21.23	24.921
Sulphur	0.68	
Phosphorus	0.33	

IX. Several animal aliments contain both nitrogenised & non nitrogenised matter. Milk contains Casein a nitrogenized substance; it contains butter which is non nitrogenised, & ales a large quantity of Sugar, called Sugar of milk which is much used by Homeopathists; it contains chloride of potassium, chloride of Sodium, which are met with in the blood, & the second essential fluid of the body: phosphate of Soda contained in the brain, phosphate of lime which goes to form the bones of the young being, & phosphate of magnesia which goes to the same purpose; it ales contains phosphate of iron which goes to form the blood. Some animal & vegitable substances contain both non- & nitrogenised matter.

Flour, for example, contains gluten which is similar to the fibrin of the animal & it contains, on analysis a little albumen & Casein, & by drying it with ether you can find oil in it, which goes to the fattening of animals, when vegitable articles are used as food; it has Sugar & Starch, & the same salts that are found in the milk, & this proves the great analogy between the animal & vegitable, both of which help to form the blood which contains fibrin, albumen jelly, Casein in the red globules; globulin which is blood Casein, & its coloring matter which is nitrogenized, it has also a considerable quantity of fat & also Sugar, & the same salts as in the animal & vegitable substances.

Therefore the arrangement of aliments becomes.

1. Nitrogenized or albuminous	fibrin, albumen, Casein, Gelatin	milk: Curd or Casein	Flour: fibrin (Gluten), albumen, Casein	Blood: fibrin, albumen, Casein (globulin), Coloring matter
2. Non-nitrogenized	Amylaceous, Saccharine, Oleaginous	Butter	oil	Fat
		Sugar	Sugar Starch	Sugar.
		Chloride of potassium, " " Sodium, Phosphate of Soda, " " Lime, " " Magnesia, " " Iron	Do	Do

It is therefore necessary for proper nutrition, that the animal should take animal & vegitable, or nitrogenized & non nitrogenized articles, a proper

admixture of which is generally found to be best adapted for the nutrition of persons exposed to labor as in the Case of the United States Navy where the Diet of the United States Navy consists of

Three days in the week	Two days in the week	Two days in the week
1. Nitrogenized pork ℥ xvi	1. Nitrogenized beef ℥ xvi	1. Nitrogenized beef ℥ xiv
Beans & peas ℥ viii	" Flour ℥ viii	cheese ℥ ii
2. Non-nitrogenized Biscuit ℥ xiv	2. Non-nitrogenized dried fruit ℥ iv	2. Non-nitrogenized rice ℥ viii
pickles & cranberries ℥ i	biscuit ℥ xiv tea & Sugar ℥ ii ℔	butter ℥ ii biscuit ℥ xiv
Sugar ℥ ii	pickles & cranberries ℥ i	Tea & Sugar ℥ ii ℔
Tea ℥ ℔ Total ℥ 40 ℔	Total ℥ 45 ℔	pickles & cranberries ℥ i
		Total ℥ 45 ℔

The notice an individual has of his want of food is hunger which arises from the condition of the stomach. You may have a need for reparation over the whole economy, & the one particular part to which it is referred is the Stomach. Appetite is artificial & belongs to the Sensations & is connected largely with the nervous System & can readily be restrained, so Can hunger be restrained but not for a great length of time In the lower animals where there is a want of food the same Sensation Inmet Eliet. The Sense of hunger originating in the stomach is referred to the brain & back again to the stomach. Even in vegitable there is Something like hunger & in the lower class of organized

bodies independent of nerves, as in the case of a plant, placed beyond the reach of water, will send its rootlets to the nearest damp spot to procure water for its nutriment. We do not know how the sensation of hunger is produced. There is an impression on the economy of all animals, a desire, under special circumstances for food asserting the wants of the System generally not dependant on the nervous System

X. The greatest cause of ordinary ailments is the very large quantity of food taken in the body, & sometimes the quality. Under long habit very little animal food is necessary to nourish the body.

The digestive apparatus is very simple in the lower animals, but becomes higher as we ascend the scale. In the herbivorous animals, the alimentary Canal is very large being 28 times as long as the body; in the carnivorous animals 3 times the length of the body, & in man it is 6 times the length of the body. In some animals there are two stomachs, in others four, corresponding to the one stomach we find in man. Man is omnivorous, neither entirely carnivorous or herbivorous, & is between them in the arrangement of the alimentary Canal. In man there is at the commencement of the Canal an arrangement by which the first step of digestion is effected, by which he shall

pare the different materials received into the mouth. He has teeth which are concerned in one of the first steps of the digestive process, for lacerating, cutting, triturating or pressing. The teeth are therefore suited to all substances. The teeth are the mark of the characteristic of the animal. The incisor teeth are present in Carnivorous animals, & these are little molar teeth; in the herbivorous animals the teeth are flat upon their surface & the jaw has something of a rotary motion, adapted for grinding articles in contact with them. This with the whole arrangement of the alimentary tube proves the omnivorousness of man. The act of mastication is produced in the mouth by the teeth. Mastication is often too much neglected; food is too often bolted & not properly masticated, & is therefore not properly prepared to enter the stomach. The materials should be divided & subdivided to have ready access to the pores in the lining membrane of the stomach & which must occur a proper digestion will not be accomplished. There is an admixture of the alimentary matter with the different fluids coming from the Salivary & Secretary organs. The Saliva is secreted to the amount of 3 ounces in the 24 hours. Starch becomes converted into Sugar by Contact

with the Solivd amylaceus matter in the mouth & preserves its change albuminous matter suffer no change until they come to the Smaller intestines. Food after being masticated & Salivated is fit for deglutition.

XI. In the interior of the Stomach there is an article thrown off from the mucous membrane called pepsin. We have also the Gastric juice which is a nitrogenized material thrown off in the Stomach & also in the mouth where it converts Starch into Sugar & in the Stomach the different gastric acids act upon it & effect the work of digestion. All digestion is produced beneath the diaphragm. The alimentary matter after having passed the root of the tongue is no longer controllable by the individual & the action which carries it down to the Oesophagus is involuntary. It touches the mucous membrane of the posterior part so as to effect the nerves which convey the impression to the centre the Spinal marrow & back again with the rapidity of lightning to the proper muscles, & they close in an involuntary action & carry it to the first part of the Oesophagus. The aliment passes down the Oesophagus till it comes to the Cardiac orifice of the Stomach, &

then entering the stomach is subjected to the changes which are effected by the secretions which take place from this organ, & the alimentary matter is afterwards passed out through the pyloric orifice into the small intestines. In the ruminating animals, the last of the four stomachs is the only one anything like that of man & is the only one having anything like gastric secretion in its Coat. Gastric juice is very strongly acid. Chyme is nothing more than the materials which may be contained in the stomach when the articles have been subjected to digestive action. They are invariably acid.

XII. Pepsin is a nitrogenized organic matter known as forming the lining membrane of the stomach & as the aliment seems to be in movement aids in its digestion. Its movement is communicated to the material with which it is mixed, & it enables the gastric juice & acids to dissolve the material subjected to it in the stomach. It may be obtained without much difficulty. Take the mucous membrane of a human stomach a few pebbles stomach of a ruminating animal & use a slightly acidulated liquid

A small quantity of this ferment added to any animal food, produces a change analagous to that produced in the stomach, similarly to the principles by which barley is converted into malt. Pepsin acts upon albuminous matter & converts them into chyme, which is only the change produced upon any aliment in the stomach whether animal or vegitable substance. Pepsin is an article full of moment. It is a portion of the mucous membrane in a state of incipient decomposition, which is thrown off from the interior of the stomach to be mixed with alimentary matter & produce the changes necessary. Where a secretion is formed on a membrane it takes place from the investing of that mucous membrane. From the free surface of the stomach there are cylindrical tubes running to the peritoneum & the tubular cells are only continuations of the lining membrane of the stomach, & in these we have the secretions of the stomach & at the bottom we have cells. These tubes are filled with solutions of a peculiar character whose function is to secrete the proper mucous matter of the stomach. There is in the course of 24 hours created a mass of fluid which is necessary that digestion shall be fully effected. There are a great quantity of secretions taking place at the splenic portion of the stomach

After it reaches the pyloric orifice, there has been such a change produced on the aliment, that from the villi of the mucous membrane the materials will be taken up by the blood vessels & carried into the System. Blood vessels exist in great quantity in the mucous membrane of the alimentary Canal. In the Splenic portion the blood vessels run around spaces in which there are glands opening, & at the pyloric orifice they are in projections like the pile on velvet. The pyloric orifice takes up the nutritive matter which has been acted upon. The aliments pass in at the Splenic orifice, go around the greater curvature of the stomach & up again to the place of entering, & this takes from 1 to 3 minutes according to the activity of the muscles. The muscles of the stomach consist first of longitudinal fibres & next of circular fibres & there are a third layer of muscular fibres which are obligue. They pass over the Cardiac portion down towards the greater curvature of the stomach, & this arrangement by contraction, gives occasion to a movement of the material in the organ, which will be thrown about in a churning manner. The Cardiac orifice is well closed by muscular fibres, & the pylorus has a perfect Sphincter. While the food is in the organ we have only

gastric digestion taking place. Many materials experience no change in the stomach & only after having passed the stomach. In the stomach albumen becomes changed by mixture with the gastric secretions, for, as albumen it is not fit to pass into the mass of blood & go to the nutrition of tissues, & after mixture with the gastric secretions it becomes entirely histogenetic. Cane sugar has the same properties. The alimentary matter subjected to the action of the gastric secretions, is changed so as to be worthy of assimilation.

XIII. There is a digestion which takes place lower down than the stomach, where, in the duodenum, you have the greatest gland in the body, pouring out a material to be mixed with the aliment; & you have a gland called the Pancreas pouring its fluid into the intestine & an important part of the digestion takes place here in the small intestines which are about 20 feet long from the pylonic orifice to the part where it opens into the large intestine. The small intestines are studded with innumerable follicles which are placed precisely in the same manner they are in the stomach, & they are only concerned in forming a kind of mucus to be mixed with the excrementitious matter as it passes along, softens it, & lubricates the membranes

to allow the alimentary matter to pass readily along in its proper track. There are other glands, particularly seated at the Commencement of the Small intestines which are granular glands from which the ducts are formed by tubular invertion, & there is in the follicles contained in them a material found out to go upon the free Surface of the lining membrane of the intestine & where the Small intestine terminates in the large intestine you have the glands of Peyer which are not glands in the Common acceptance of the term. They belong either to the lymphatic System, & they Communicate with the mesenteric glands, & they are absorbents instead of Secretory glands, having no Excretory duct for which there is indeed no necessity as the glands are not intended to Separate anything from the blood. At the Commencement of the Small intestines the duct of the hepatic gland & the gland of the gall bladder end in the ductus Communis Coledocus & enter the intestine. You have also the duct of the pancreas or Sweet bread which in man opens with the other & the two are joined together in the Small intestines. The precise function of the fluid (the bile) Secreted from the liver is not well known. The bile is less important in digestion than it is usually

supposed to be. The amount of biliary matter in the feces is exceedingly small as contained in the large intestines, & instead of being an excrementitious matter, it is a matter poured out to become mixed with the alimentary matter & is then taken up again & received into the mass of blood. It consists essentially of a hyder Carbon. The ductus Communis Coledrus has been brought out of the body in the form of a fistula, & the discharge allowed to fall outside the body; & no serious difficulty in digestion has been produced & no injury has been done to the nutrition which has been as well carried on as when the bile was poured out into the alimentary Canal. Its secretion stimulates unduly the parts over which it has to pass & it produces no excitement on the lining membrane of the stomach. It does produce some change by its mixture with the alimentary matter, & it is of an antiputrescent character. It keeps the materials free from the decomposition they are liable to from being in a mucous surface with plenty of water and at a temperature of 100° & on substances highly subject to putrescence. The fluid secreted by the pancreas mixed with the bile has a greater importance. The pancreas is like the salivary glands in the mouth. When subjected to analysis it

differs somewhat from that produced by the Salivary glands proper but not much & it has therefore been described as the abdominal Salivary gland. The fluid converts Starchy matter into Sugar. When you take oily matter & mix it with this fluid there is a secretion produced which enables the oily matter to pass readily into the mass of blood through the Villæ contained in the mucous membrane of the intestines, & its great use is to emulsify any oleaginous matter which may be taken in the economy. The bile when mixed with the pancreatic juice has a greater effect in producing emulsification of the oleaginous matter, & more so when combined with the fluid secreted from the lining membrane. The arrangement of the canal is such that the mucus it contains shall be well mixed with the alimentary matter which pass throughit.

XIV. Where the Small intestine ends in the large intestine, it is arranged so as to detain the alimentary matter, & when it has gathered it passes through a process to allow the dry part of the feces to be taken up & the excrementary matter to become harder & harder. At the termination of the Small intestine there is an arrangement which almost entirely closes the aperture but

allows the matter to pass on & all tendency for it to return is prevented by the folds arranged there Called the ileo Cecal valve. There is attached to the Cecum a small appendix Called the vermiform appendix of the Cecum & is an opening to the duct, & it is a vestige of the large cecum found Among other animals particularly the herbivorous animals. This appendix is subject to accidents which bring on peritonitus, & death follows unavoidably. It sometimes extends to the large intestine & forms an abscess opening externally. The muscular fibres of the large intestine are longitudinal & circular & are in bands. The Excrements have something of the shape of the intestine from which they are voided. There is a sort of motion through the whole intestine Called the peristaltic motion, it is a movement inherent in the structure of the intestine a process independent of the nerves distributed to it.

XV. The pneumogastric is the nerve connected with the movements of the muscles of the Stomach. At the termination of the Canal there is an arrangement of muscles partly under the influence of the will & partly removed from every act of volition. When the nerves which go to them are weak, we have sometimes involuntary

examination of experiments, which shew the nerves are no longer able to keep the Sphincter closed, thus there is an analogy of mixed muscles in ingestion & egestion. When the matter comes in the large intestine, or coming to the rectum, the impression made is carried to the brain & is reflected back to the proper muscles which force the sphincter ani, & thus the act of defication is accomplished. Previous to this the faeces become indurated owing to the dry portion being taken up by absorbtion from the lining membrane of the large intestines. The amount of faeces deputated in the 24 hours is not more than 4 or 5 ounces, & not more than one ounce of that consists of purely solid matter. Digestion so far is applied to the solid matter taken in the alimentary Canal. Fluid matters are not subject to any digestive process, but very readily & simply enter the economy. When fluids are combined with solids they sometimes become mixed with the digestive secretions & if they attain a proper degree of tenuity can pass into the different parts of the blood & becoming appropriated are converted into the living tissues. Saccharine matter with bile can be formed into oleaginous matter, All the nitrogenised & unnitrogenised

matters & experience some change either in the stomach or in the small intestines through the influence of fluids secreted by the pancreas, & by the bile, & from the fluids secreted from the glands in the lining membrane of the small intestines.

XVI. The digestive organs are bound together & bound down by a membrane called the peritoneum, belonging to the class of serous membranes. A serous membrane always goes to the formation of a shut sac except in the peritoneum of the female where it mingles with the mucous membrane at the commencement of the fallopian tubes. It forms the outer coat of the stomach, the outer coat of the liver, the coverings of the different intestines & the stomach, lines the cavity of the abdomen. There is not a single organ connected with a serous membrane that is in the cavity of that membrane, but is always behind the serous membrane. The cavity of the peritoneum, is that portion between the peritoneum lining the anterior of the abdomen, & the peritoneum covering the viscera. The peritoneum is not very liable to disease. The most common cause of indigestion arises from the acids in the stomach. It sometimes arises from the taking in of pie crust & salt meats. There

an certain articles of food which taken in the Stomach when it has not Sufficient time to grapple well with them, will give rise to the formation of Some acid giving rise to what is called heart burn. The different articles must get upon the lining membrane of the Stomach & give rise to the formation of Some acid which will Cause indigestion. To remove this acid in the Stomach you must give an alkali. This is often benefitted by Travelling ringing about new Scenes, new thoughts, new faces new desires & occupation & this change on the nervous System is very beneficial.

XVII. The lining membrane of the Stomach & intestine is liable to irritation which may extend to the liver & pancreas & bring on an increase of the Secretion of these organs. If there is inflammation, the Secretions will be first diminished, & afterwards augment in a diseased form. Sometimes indigestion gives rise to regurgitation which has been said occasionally to give rise to rumination.

Vomiting Seems to depend on an inverted action of the Stomach & also on the action of the diaphragm & abdominal muscles; the contraction of the diaphragm & abdominal muscles has most to do

in the act of vomiting, & there is some degree of pulsation on the intestines. Sometimes in long protracted cases of fever the lining membrane of the alimentary Canal will give rise to the formation of air. There may be a passage of air from the blood vessels into the intestinal Canal by Exosmose which may give rise to this formation. By experiment, the gases found in the different part of the intestinal Canal one hour after eating, are as follow

Gases found in different parts of the intestinal Canal.

	Stomach.	Small Intestines.	Caecum.	Rectum
Oxygen	11.00	0.00	0.00	0.00
Carbonic Acid	14.00	24.39	12.50	42.86
Hydrogen	3.55	55.53	7.50	0.00
Carburetted Do	0.00	000	12.50	11.18
Nitrogen	71.45	20.08	67.50	45.96
Sulphuretted hydrogen	or	or	or	Traces
	100.00	100.00	100.00	100.00

XVIII. The changes occurring in digestion are physical & chemical changes. The matter after going through this process must be taken up by absorption, & this function is performed in the vegetable as

well as in animals, & in the plant is performed by endosmose. At the terminal extremity of the rootlets of a vegitable is a Spongiole which is only a soft Cell made of a very thin pelicle, which allows fluids to pass from the exterior to the interior & Conversely. The water in contact with the exterior of the rootlets is in a condition to be absorbed, & will pass into the cavity, & fresh & fresh portions passing in will fill the Spongiole & force the material along the Capillary tubes that go to the constitution of the vegitable, & the crude Sap passes up to the Stem & Stalk & is there distributed to the leaves, & there undergoes a change; in a function executed by the animal there is a Similar act of absorption, or the passing in of a thin material from the exterior to the interior of the Spongiole. Air can pass in in the Same manner & may be instrument to digestion. In the Simple monad Consisting of a vesicle & a thin material in its interior, & in the Simple Cell that forms the basis of all economy the action of absorption is executed in the Same manner as in the vegitable. A most important part of digestive absorption is performed altogether by the veins. If Substances are passed in the Stomach & have the necessary degree of tenuity, they pass into

the veins of the stomach; & all the veins of the Stomach & Small intestines unite to form the large vein, the vena porta, which goes to the liver, & the blood passed from the stomach & intestines must be distributed to the liver; & thus can we understand how liver disease may occur in persons addicted to alcoholic liquors in large quantity. After going to the liver & being there distributed to the vena Cava, & going to the heart it is at last distributed through the system. The liver is a great assimilating organ, for one of its chief functions is to elaborate the materials in the alimentary Canal which must be subjected to changes in this organ, before it goes to the System at large. Thus our medicines are distributed to the different tissues, & if it has an affinity for any particular organ, it will proceed to that organ and effect there the changes designed. Solids can pass by absorption into the veins under special circumstances when it is in a very fine state of division. The blood vessels in the human body hurry on the fluid they contain with great velocity, many small particles are on the outer Surface of the mucous membrane, & the velocity exerts a degree of attraction, & Such membranes being porous, the pores allow the particles of Solid matter to pass immediately through them

The chyliferous vessels are also engaged in the function of absorption. In the intestinal Canal you have separated by the chyliferous vessels a homogeneous fluid having all the characteristics of blood as contained in the blood vessels except the color, & it is therefore called rudimental blood. The blood in its course to the venous system is subjected to various changes. The commencement of a chyliferous vessel is in a villus, & there are cells placed there to receive the different materials from the aliments, & when they have formed this chyle they pass interiorly & it is swept down the villus until it reaches the chyliferous vessels.

XIX. In the human body when fat is taken in it becomes emulsified & it passes through the free surface of the membrane & becomes mixed with the liquor Sanguinis of the blood, & in the veins of the intestinal Canal, fatty matters are found in considerable quantity. The chyliferous vessels are in fact only lymphatic vessels which Empty into the Same trunk. In every part of the Economy there are lymphatics. When an individual has been fasting for Some time, there is nothing identical with chyle in the chyliferous vessels, but there is a material which closely resembles the lymph

in the lymphatic vessels. While digestion is going on they contain a fluid which is chyle. The fluid contained in the chyliferic vessels & in the lymphatic vessels bear a close resemblance. Chyle is a substance similar to the blood, undergoing a coagulation & having much the same constituents as the blood, & in the villae of the intestinal canal is a process which constitutes the very beginning of blood making.

XX. The chyle contained in the lacteals proceeding from the intestine to the thoracic duct, is as follows.

1. In afferent lacteals from the intestine to the glands
   - Fat in maximum. Many oil globules.
   - albumen in minimum. few or no chyle corpuscles.
   - Fibrin almost wanting

2. In efferent lacteals from glands to thoracic duct
   - Fat in medium. fewer oil globules
   - albumen in maximum. imperfect corpuscles
   - Fibrin in medium.

3. In the thoracic duct
   - Fat in minimum.
   - albumen in medium
   - Fibrin maximum. perfect corpuscles

The whole chyliferic & lymphatic system is an elaborating apparatus & the lymph & the chyle are very much alike in their composition. The lymph in the lymphatic vessels is a part of nutritive absorption.

XXI. Absorption is carried on in various ways.

External absorption { Gastro pulmonary, Genito-urinary, Cutaneous } Absorption

Internal absorption { Shut Sacs, interstitial }

The act of respiration is a sort of absorption, an act of absorption of gases. Some things pass more readily through the lining membrane of the pulmonary apparatus, than they do through the lining membrane of the stomach. The amount of penetrativeness of the materials brought in contact with a membrane is different & will cause a difference in absorption. In the genito-urinary apparatus the membrane is enables materials to pass more readily along it; it lubricates the outlet & enables the fluid to pass over it without producing any degree of irritation, but it is an internal absorption because every mucous membrane is a prolongation of the common integument of the body. There is also absorption taking place on the cutaneous surface of the body, & this absorption is not easily performed. The prevention of ready absorption is owing to the presence

there of an organic medium. When the cuticle is exceedingly thin, absorption is much more easily performed. There is also an internal absorption, which may take place through closed sacs where absorption takes place from serous membranes. There is also an interstitial absorption which is always going on in the tissues & the absorption is effected by the lymphatics. If there is anemia of the blood absorption will not be effected in such an easy manner as otherwise.

XXII. Respiration occurs in the plant as well as the animal. In the higher orders of animals there is a necessity for the blood in some way to get in contact with the air. The apparatus for this purpose consists of a long tube the trachea terminating in bronchae which ramify, becoming smaller & smaller & penetrating the cells until they become extremely minute & terminate with what have been called air cells. After air has once passed into the cells of the lungs it cannot be got out with ordinary pressure. There is therefore a certain quantity of residuary air always present. Breathing is produced either abdominally or costally, through the influence of the diaphragm, & by the expansion & retraction of the ribs. the first in ordinary respiration, the latter after uncommon exertion

XXIII. The lungs nearly fill the Cavity of the chest, Consequently the chest is always more or less filled with air, & on this depends the great usefulness of percussion in the diagnosis of disease. When there is dullness it shews there has been some depreition or that the lung has become in some degree Consolidated. There is also a somewhat analagous process Called Auscultation by which you get Sounds friction or otherwise, & this enables us to judge of what is going on in the Economy, & gives us the pathological anatomy of the living body. The residuary air always present in the lungs is renewed & kept up by inspiration.

XXIV. In a man of fair high, the air in the lungs may be taken as follows, Complimental air 110 cubic inches, breathing air 25 cubick inches, reserve air 100 cubic inches, & residual air 100 cubic inches. A healthy person generally makes 16 respirations in a minute, & the number of pulsations are 70 in the same period. This varies according to different circumstances. A very young child breathes more rapidly, at the adult age he breaths more slowly say from 16 to 20 respirations per minute while in his earliest days he made 35 or 40 respirations a minute.

At the age of 40 or 50 it becomes more rapid until advanced age. The respiratory period consists of 4 seconds in which the inspiratory period has been reckoned at 1½ second, the Expiratory period Equal to about ½ second, & also a period of rest Equal to 2 seconds. In reality there is no such difference between the inspiratory & Expiratory periods. The female breathes more with the upper part of the chest than the male does, & she does not breathe abdominally as much as the male. The medulla oblongata presides over the action of respiration. There are a few phenomena belonging to the mechanical phenomena of inspiration & Expiration; & there are also some which are partly inspiratory & partly Expiratory. They may be classed as follows.

1. Inspiratory phenomena	2. Expiratory phenomena	3. Mixed phenomena
Yawning	Coughing	Sighing
Hiccough	Sneezing	Moaning
Smelling	Spitting	Sobbing
Snoring	Blowing the nose	Laughing
	Voice	Crying
		Panting

XXV. In respiration there is oxygen passing in & carbonic acid passing out. The carbon is chiefly united with the oxygen in the liver where there is an increase of temperature, & therefor the blood on the right side of the heart is hotter than the blood on the left side The blood contains carbonic acid, oxygen & nitrogen in the following quantities.

	Carb. acid.	Oxygen.	Nitrogen	
arterial blood.	623.	232.	145	} Blood
Venous blood	716.	153.	131	} Blood

The carbonic acid formed in different parts of the economy, differs in quantity. There is a larger quantity given off in the 24 hours by the male than by the female, & this may be owing to the greater activity of the male & the female is the more sedentary. The quantity of carbonic acid exhaled can be measured. There is more given off in the day than in the night. When an individual is thrown into water, he is thrown into a state of Apnea, & the respiration ceases in 3½ minutes In the hanging process the heart beats some minutes after the cessation of respiration; which must be explained by the supposition that under special circumstances respiration is carried on in

different parts of the body. The venous blood of the body passing to the heart is sent to the lungs through the pulmonary artery, & is converted into red or arterial blood, & after leaving the lungs is brought to the other side of the heart & is then distributed to the different parts of the body, & therefore there are two circulations of the blood.

XXVI. The general physiology of Apnea is there is an accumulation of blood on the right side of the heart, black blood necessarily, & there is a smaller quantity than there should be in the pulmonary veins & in the left ventricle of the heart. There is also a want of proper decarbonization in the heart, & therefore, M. Bichat & others have asserted, the tissues Cannot Carry on their functions properly because they are poisoned by the Carbonic acid Contained in the blood; but Dr Dunglison thinks the Carbonic acid has nothing to do with it. The Same is true with regard to the asphyxia of the new born infant; for the blood during the intra uterine life of the foetus, is black in the arteries as it is in the veins. A new born, not having been accustomed to having its blood properly oxygenized is Capable of living for Sometime in an irrespirable fluid; but this ability is diminished as he is allowed to respire Atmospheric Air.

The apnœa is more dependant in the new born child, upon the torpor of the nervous System. In the adult one Cause of Apnœa is the torpor of the Medulla. The Evident Causes of this State of affairs are five in Number

Apnœa
1. Farm want of Expansion.
2. Inadequate Supply of Oxygen
3. Inespirable gases.
4. Mechanical Causes
5. Torpor of Medulla

The most frequent Cause of Apnœa is by drowning; an Eminent Frenchman has estimated the following

Causes of death in drowning.

Apnœa pure	25.00	Apnœa 87.50
Do & Syncope	62.50	
with Cerebral congestion		
Syncope Apoplexy & Concussion	12.50	
Persons	100.	

XXVII. In cases of death from drowning, or rather supposed death from drowning, the attempts at resuscitation should be continued for some time. The patient should not be taken in a warm room & warmth should be applied to the body; but he should be stripped & placed in a room at the ordinary temperature, for there may be a greediness of absorption for oxygen to try to convert the venous blood into arterial, & if this can once be induced the cause of obstruction is removed. Artificial respiration must be resorted to in all cases. Employ frictions over the entire surface. Some animals can remain for a long period where there is little action of respiration & also there are some which can do without nutrition, but there is much difference between the power of different animals. This is proved in the case of a toad enclosed in a stone; but man & the upper classes of animals require a full supply of atmospheric air. Contagious diseases are generally found to occur from the taking in of ~~Oxygen~~ atmospheric air in which the disease is prevalent. There is an emanation from soils which are malarious, which is taken in with the air of respiration, & gives occasion to this class of diseases. They seem to come

in contact with the living cells, but they are not the product of vegitable or animal decomposition.

XXXVIII. There are certain deteriorations which take place in the atmosphere where many people are grouped together & which is unfit for respiration. The nitrogenous matters thrown off from the lungs & surface of the body produce many of those diseases which affect Communities. All animals Crowded together where there is little ventilation fall off in their nutrition. They play an important part in those epidemic & endemic diseases which occur from time to time as cholera &c. There are various diseases affecting different parts of the Economy as seen in the table below.

Pathological Applications

Diseases

1. Involving the mucous lining { Laryngo Tracheitis, Bronchitis } generally Capillary

2. Involving the Cells plus the areolar tissue { Pneumonia, Gangrene, Oedema, Emphysema, Cancer, Melanosis, Tubercles }

3. Diseases Essentially Nervous { Spasm of the glottis, Asthma, Whooping Cough, Hiccough }

4. Involving the pleura { Pleuritis, hydrothorax, pythorax, pneumothorax } 5. { being to run Convulsion of Venous into arterial blood } Apnœa

XXIX. As the arterial blood passes through the body the tissues take up those parts they want for their nutrition, and therefore as it proceeds through the Economy it becomes less & less arterial, and becomes more and more venous, & therefore there is a circulatory apparatus which Conveys the blood from the left Side of the heart, through the tissues, to the right Side. This must also occur in those lower Clases of animals which we know have no hearts; and there must of necessity be an analagous circulatory System in the vegitable. In Man and the higher orders of animals there is an organ the heart placed expressly to propel the blood to all parts of the System. The heart of man is not a Single organ but consists Essentially of two portions, a two hearts the anterior & the posterior heart.

XXX. In the heart the left ventricle is three times the thickness of the right ventricle. The ventricle is the portion

Concerned in passing the blood through the economy, and the auricle plays only a small part being simply a receptacle for the blood. The rythm of the hearts action, is the regular alternate Contraction which takes place in the organ. & in the heart it occupies a period equal to 4, & may be divided as seen in the following table

Series of the hearts Action, (Rythm) Time = 4

First or inferior Sound	Second or Superior Sound	Interval
Time = 2	Time = 1	Time = 1
Ventricular Contraction Auricular dilatation Impulse	First Stage of ventricular dilatation	Short repose, followed by Contraction of auricles. Second Stage of ventricular dilatation

The first Sound is a long dull Sound equal to 2 followed by the 2nd Sound equal to 1, & then there is an interval Equal to about 4 when the first Sound again occurs, & so on. During the first Sound there is the ventricular Contraction of both ventricles; at the Same time the auricles must be dilated because they are receiving blood by the vena Cava ascendens & the vena cava descendens, & the coronary veins & there is a beat of the

heart against the chest. The second sound occurs in consequence of the dilatation of the ventricle immediately following the Contraction, in consequence of the blood passing the lunger valves which brings them down giving occasion to the peculiar second sound of the heart. Then there is a brief period of repose, & that is the only time at which the auricles Contract & send a small quantity of blood into the interior of the ventricle, just enough to fill it, & there is a second stage of ventricular dilatation, & then the same process is repeated as before, & so on. A certain degree of the first sound is due to the muscular Contraction of the organ; the blood is pressed & forced back against the auriculo ventricular valves & this must produce a sound of the heart as if it were rough, & the friction of the blood over a rough surface gives occasion to a certain amount of sound; & therefore the first sound of the heart originates from a variety of causes. 1st, the sound of the simple Contraction of the parieties of the ventricle, that produced by the blood being pressed against the valves, & next that produced from passing over a rough surface, a lesser sound because it passes through

the Semilunar valves. The first Sound is Synchronous with the Systole of the heart & the Second occurs during the diastole of the heath.

XXXI. If the tricuspid valve has any deposits upon it, if the watery parts go off & the solid portions remain together, it gives occasion to a Continued opening. In the Case of the mitral valve where part of the blood passes back to the left ventricle and all does not pass through the aorta, this produces different Sounds. In the Case of the Semilunar valves in the Same Condition there will be a partial return of the blood. If the inferior Sound is more loud, the affection is in the mitral valve; if the Sounds are heard more distinctly at the base you infer the mischief exists in the Semilunar valves. The Sound given is due to the contraction of the tube through which the blood passes, and has no Such indication as is with the blood itself.

These different Sounds are heard on listening at the chest, and may be arranged into two Classes, 1st the Endocardial which are inside the heart, & 2nd the Exocardial which are between the folds of the pericardium Surrounding

the heart and may be divided as in the following table

1. Endocardial. Bloving { Bellows, rasping, filing, sawing, musical

2. Epocardial ..... Friction of various kinds.

The contraction of the heart does not depend upon the nervous System, for if the nervous centres are gradually destroyed the heart will go on Contracting & dilating without much perceptible difference. Like the intestinal Canal, there is Something peculiar in the hearts of animals giving rise to this phenomena. The heart may, perhaps, beat on account of the necessity it has for Oxygen.

XXXII. The lining membrane of the arteries is only an extension of the lining membrane of the heart. The aorta after leaving the heart Consists essentially of elastic tissue, & also Some few muscular fibres. The elastic Coat keeps a Constant pressure on the blood, & the flow is Continuous. At the Same time the contraction of the heart Sends

fresh & fresh portions of blood into the large trunks, & this keeps the vessel down to a proper size; & this action is performed by the muscular fibres in the smaller arteries. The arteries are always empty after death, one cause of which is that the capillary circulation draws the blood from the arteries to the veins. After the blood has proceeded through all the larger & smaller arteries, it comes to the tissues of the body where there are important physiological functions to perform, as they are the seat of all nutrition physiological or otherwise. The arteries become smaller & smaller as they subdivide until they form capillary passages & the blood percolating through them comes into medriate contact with the cells of which the tissues are composed, without undergoing the change from arterial to venous blood, which passes in the veins & is carried to the right side of the heart. The capillary

is due to the affinity between the arterial blood and the lining membrane of the capillaries

XXXIII. The venous trunks are larger than those of the arteries, but are not so firm as the arterial trunks.

Therefore the veins are capable of conveying much more blood than the arteries, but the blood cannot pass as rapidly through the veins as it does through the arteries. The Constitution of the vein is essentially like that of the artery. There is the lining membrane & muscular fibres but a less number; there is less elasticity in the veins; & through the veins the blood is sent into the right auricle of the heart & thus is completed the greater circulation of the blood. The pulse of the heart occurs during the Contraction of the ventricles, & it is Communicated along the arteries, but is more slight in the Smaller arteries, until at last in the Smallest arteries it is hardly at all perceived. The impulse is also felt along the parieties of the vessel. The pulse at the wrist is not entirely Synchronous with the pulsation of the heart, but the Communication is so rapid along the arteries that there is but very little difference between the two. There is a movement of the artery during the Contraction of the ventricle, which is called the legumen of the artery. Pulses differ very much in their character, & in different individuals.

The average pulse of man at different ages.

Foetus in utero	140 to 150	beats in the minute
New born child	130 to 140	" " "
First year	115 to 130	" " "
Second "	110 to 115	" " "
Third "	95 to 105	" " "
From 7th to 14th year	80 to 90	" " "
" 14 " 21 "	75 to 85	" " "
" 21 " 60 "	70 to 75	" " "
" 60 & upwards	75 to 80	" " "

The pulse of children is very often irregular, & there is also some intermission at the age of second childishness - The pulse of a woman is generally on the average 10 beats more rapid than the pulse of the male. The pulse may indicate to us information, within certain limits, respecting the quantity of blood circulating in the vessels. In feeling the pulse the most important matter is to judge of the heart's action. The quick pulse is a pulse of reaction as where a woman has been reduced to death's door by

uterine hemorrhage & two or three hours afterwards, she may be flushed in the face, & the arteries may become filled, & the pulse strikes rapidly against the finger. Or it may be dependant on fullness of the blood or on inflammation or exithism. The following table will exhibit the most important indications given by the pulse.

The pulse indicates

1st The quantity of blood ..... full, small

2nd Character of Heart's action { strong, weak / frequent, slow / quick, shattered.

3rd Condition of vessels { hard, soft / tense, cordy / dicrotic

4th Rythm of heart's action { regular, irregular / intermittent.

The circulation may go on without any nervous influence, & this is the means of much mischief by persons mistaking the cause, & then bleeding or

woman when she cannot afford to lose any blood.
The condition of the vessels is determined by the beat of the heart. There is a pulse of a double beat called dicrotic in some cases of adynamic fever.

XXXIV. The pulse differs very much according to the position of the body, & whenever exercise is employed, there is always an increase of the pulse. In the healthy state, the pulse is more frequent in the morning than in the after part of the day. There is a power of derivation which helps the circulation. The circulation is performed with amazing velocity, & is accomplished in less than 40 Seconds. Therefore a poison sent in a vessel is brought into almost immediate contact with the organs upon which it has to exert it malign influence. The velocity is greater as the vessels are narrower. The Capacity of the branches of a trunk is very nearly the same as the Capacity of the parent trunk, but as they ramify the area of the joint Capacities becomes somewhat greater than the diameters of the parent trunk. The

velocity of the circulation is diminished by the curvatures of the vessels, and also by the angle at which they pass off from the parent trunk, as the fluid will pass out with more rapidity at an acute, than it will at a right angle

XXXV. The degree of pressure in the different vessels of the economy is ascertained by the hæmodynamometer. The force of gravity facilitates the passage of blood to the extremities when the individual is in the erect posture, but in the return of the blood it acts as an impediment. There is another circulation of the blood called the portal circle which has not been understood until within late years. There has been prevalent a theory, that there is at different times in the skull a different amount of blood, notwithstanding the atmospheric theory. In the case of reaction of some tissues, the capillaries become charged with blood, but before any effect can be made an impression must first be made upon the nerves of the part.

XXXVI. The blood sent to the lungs must nourish the lungs, as well as receive Oxygen from them. It is sent as venous blood, & returns from these parts as arterial blood. In all other parts of the body, blood is distributed & conveyed by the arteries, & is returned by the veins. Nutrition is the function by which old parts are taken away, in all parts of the body, & by which new parts are formed in their place. There is a perpetual change going on, from the first moments of existence to its cessation, by which old parts are taken up & new parts deposited. This must be performed through the medium of the great circulatory fluid, the blood, which must experience different changes. The function is exerted by the cells which are outside the vessels; the blood is sent to the cells, & it is the pabulum from which the cells are to form tissue, but independently, & outside of any action of the vessels. The materials which are to go to nutrition are contained in the blood; but all the parts of the blood do not go out to form the nutriment for the body. The blood consists of a fluid called Liquor Sanguinis, sometimes called plasma; consisting of fibrine albumen, salts & water; & swimming in this liquor Sanguinis

There are red particles called red Corpuscles, which consist of globulin and hematin. These are the Constituents of the blood while it is circulating in the blood vessels. Wherever there is a proces of separation to be effected, it is the liquor Sanguinis of the blood which passes out. There is only one occasion in which the red corpuscles pass out in the healthy function of parts, & that occasion is in the Catamenial flow. The function of the red Corpuscles is therefore Confined to the interior of the vessels. The blood in the foetus is formed from the two cells of the parents Converted into one in a fecundating Copulation, the same as every tissue is formed from the first Simple Cell; and imperfect blood must exist until the organs, the lymphatics, the chyliferous and bloodvessels are formed, & then the blood is mainly formed at the very radicles of the lymphatic & chyliferous vessels, & the matters from which the blood is formed are received by the chyliferous & lymphatic vessels, from the materials found in the alimentary Canal. The red Corpuscles are formed from the chyle and lymph corpuscles becoming more & more developed. It does not

become true blood, until venous blood has been received into the lungs, & has had its great changes effected upon it. The blood goes to the lungs as blue or black blood, & when it comes from the lungs, it is beautiful red blood of a rich vermillion color.

XXXVII. The red Corpuscles consist of an Extrin pellicle or cell wall, and have in their interior a protean Compound a fluid matter, but they do not possess all the different powers that the living cells of the tissues possess. The coloring matter of the red Corpuscles is Capable of being crystallized in masses of a prismatic shape. The blood cell is never seen reproducing itself. These cells have the power of permitting fluids to pass through them in either direction, under certain circumstances. When the blood is taken from the vessels, it undergoes the process of Coagulation & there are two parts; the crassamentum, & the Serum. The Serum is the liquor Sanguinis deprived of its fibrine which has become united with the red and white Corpuscles of the blood. The Crassamentum is Composed of the red Corpuscles & the fibrine,

and the Serum is Composed of the albumen, Salts, and water.
At the Commencement of the Coagulation, the clot occupies nearly the whole of the vessel, but afterwards, it becomes Smaller & Smaller. There are white Corpuscles in the blood, which are the chyle & lymph Corpuscles, which have passed up into the vessels without undergoing the change into red Corpuscles, and which may always remain in the Same Condition. The clot is more or less undulated on its Surface. The act of Coagulation is simply a physical process, which is a property possessed by fibrine and certain other Substances which are Spontaneously Coagulable.

XXXVIII. There are many circumstances which interfere with the Coagulation of the blood. It gives rise to what is Called the buffy Coat of the blood. The red Corpuscles having sunk in the liquor Sanguinis, the white Corpuscles are entangled with the liquor Sanguinis & being lighter than the red corpuscles remain in the buffy Coat. When the blood Coagulates there is an attraction between the different portions of

the fibrine. When there is internal inflammation there is an increase of fibrine, & the clot, after a while, assumes a cupped appearance & becomes very firm. The principal Constituents of the blood are in 1000 parts of blood, there are from 2 to 3½ parts of fibrine; of red Corpuscles there are from 110 to 150 parts of Solid matter of Serum, there are from 72 to 85 parts consisting chiefly of albumen; of Extractive, fatty & other matters are contained in 6.77 parts in the thousand. Of Saline matter there is 6.03 parts & of water from 760 to 815 parts. A more complete table is the following

Constituents of the Blood

Water	784
albumen	70
Fibrin	22
Red Corpuscles	
Globulin	123.5
Hæmatin	7.5
Fatty matters	
Cholesterin	008

Fatty matters

Cholesterin	0.08	
Cerebrin	.04	
Senotin	.02	1.3
Oleic & margaric acids		
Volatile & odorous fatty acid		
Fat with phosphorus		

Inorganic Salts

Chloride of Sodium	3.6
Chloride of potapium	0.36
Tribasic phosphate of Soda	0.2
Carbonate of Soda	0.84
Sulphate of Soda	0.28
Phosphates of Lime & Magnesia	0.25

Extractive

urea, biliary coloring matter	
gases, accidental matters &c	5.47

XXXIX. The blood of the female contains a little more water than that of the male. The blood circulating in the different parts of the body differs according to the nature of the tissues through which it passes. The corpuscles of the blood differ in their shape in different animals. As seen in the blood of the frog, the red corpuscles go in the centre, but the white corpuscles seem to fall on the sides of the vessels & make their way very sluggishly. The corpuscles, with the liquor sanguinis pass through the capillary tubes, into all the different tissues & the materials of the blood pass out of the vessels & get in contact with the living cells when they are worked up into tissue; therefore in nutrition we have nothing to do with the action of vessels, nor in perverted nutrition either, except as a secondary matter. It is not necessary that each cell should have blood vessels coming to it, that it may be nourished for the blood may pass from cell to cell until it gets to the cell which it is intended to reach; Cartilage, Cuticle, &c may be formed in this way. A nucleated cell is a body in which is carried on the nutrition. A cell must have the power of distributing materials in its interior & must be capable of working them

up. And thus, cells in immense numbers, performing this action & being associated together, may go to the formation of the peculiar tissues, & this is done by virtue of a vital power whose action is perfectly inexplicable. If there is anything interfering with the constitution of the blood, all these living cells can no longer be nourished, & therefore the whole economy suffers; and by modifying the condition of the circulating fluid, the fluids so modified comes in contact with these cells & change their character and thus produce their good effects. When hereditary taints occur, they cannot exist in the blood, but in the living cell formed by the union of the secretions furnished by both parents at a fecundating copulation

XL. Diseases must exist in the cells of the tissues. To have proper nutrition effected, a proper quantity of blood must be sent to the part, neither too much or too little. The blood must be in a proper condition, & the cells themselves should be in a proper & healthy condition. When the cells of a tissue become morbidly impressed, they often increase in number to an incredible extent. Taints being acknowledged to exist in the

primordial cells formed by both parents at a fecundating copulation; this will in part explain the cause of hereditary disease; & the causes why some children bear a likeness to one or both parents. The impression made upon the part may exist ever after, which is proved in the cases of the formation of hybrid animals; & this may explain some of the impressions made upon the intellect. When a part is subjected to unusual exertion, there is an increase of size in the part, owing to the increased action of cell agency, taking up more of the liquor sanguinis of the blood, & increasing the nutrition. In cases of hypertrophy there is an increased formative act. In the opposite condition of atrophy there is a smaller quantity of blood sent to the part & a consequent falling off of nutrition; & this is owing to a diminished formative action of the particular cells. There is a difference between growth & development. Growth is the gradual increase of the structure of a part. Development constitutes the formation of a multitude of cells all originating from one primordial cell. In morbid growth of parts the cells grow more rapidly in some particular part.

XLI.

Pathological Histology

- Nutrition
  - Increased -- Hypertrophy
  - Diminished -- Atrophy
  - Perverted
    - Inflammation
    - Induration & Softening
    - Transformation & degeneration
    - Deposits
      - Euplastic – cicatrices, false membranes cirrhosis
      - Cacoplastic – fibrocartilage, gray tubercle, atheroma
      - Aplastic – Yellow tubercle, Calcareous matter
    - Growths
      - Non malignant. Cysts, tumors, hydatids &c
      - Malignant – Carcinoma, Encephaloma, melanosis &c
      - (Paraplastic)
- Altered Mechanism
  - Contraction
  - dilatation
  - Obstruction
  - Compression
  - displacement
  - rupture &c

By the table on the preceding page we see that nutrition may be increased, diminished, & perverted, and in what manner. Hypertrophy is merely an increase of ordinary growth. Inflammation is a form of perverted nutrition accompanied with a disordered function in the Cells of nutrition. In Some Cases the cells if they are once impressed in a certain manner during life are not liable to be impressed again in the Same manner, as is evident in those diseases which only occur once in the life of an individual, but this rule like every other is liable to exceptions.

XLII. In the case of reparation of injured parts from the living tissues there is a Separation of the liquor Sanguinis of the blood & there there are poured out Exudation Corpuscles or nucleated Cells, which Come in Contact with the liquor Sanguinis, & are the Cells which are concerned in healthy growth when there is no loss of parts at all & the consequence is that at the base of the ulcer there is a healthy formation. If the Cells are protected from Contact with the air, & other Cells are thrown out into the interior of the ulcer; & these Cells become considered morbid they are less adapted for the formation of tissue, &

gradually these Cells decay, disintegrate, mix with the liquor Sanguinis of the blood which is still pumped out, & therefore, above these living Cells which are exerting their functions properly, there will be pus existing which is entirely aplastic & these are pus Cells which are incapable for forming tissue.

XLIII. The act of **Secretion** is performed much in the same manner as the act of absorption. There are some Secretions to be thrown out of the body altogether, some are to be taken up again, & there are some Secretions, part of which have to be taken up for further use in the economy, & other parts of which are thrown entirely out of the economy. The fluids which are taken up again are called recrementitial Secretions, & those thrown entirely out are Called excrementitial Secretions. A Secretion is a matter separated from the blood (pre-existing in the blood) either by an ordinary physical power; or by a more elaborate power; or by all agency. Red arterial blood must be sent to the secreting membranes & then the requisite fluid is separated either simple or Compound. This may take place without any nervous System as is seen in the vegitable where Secretion takes place & where there is no nervous System as is also the Case in the lower Animals.

In the upper clases of animals the Secretions Can be accomplished when the nerves are destroyed. The nerves may modify the degree or manner of Secretion, although they are not absolutely necessary for its accomplishment. The simplest mode of a Secreting organ is as an expanded membrane. An outer layer consisting of cells; then Comes a basement membrane, or membrane proper which is a fibrous layer, put there to support the epithelial cells; & immediately under that there is a layer of blood vessels. The arterial blood has to be distributed to the basement membrane & the epithelial cells in order that they may execute their proper functions. This arangement differs in different Situations, Sometimes there being a projection, Sometimes a depression, & Sometimes an invesion. There may be branches given out to give an increased Surface to the Structure. In the Secretions of mucus they often assume very Convoluted forms, but there is then nothing more than the same Simple arangement more or less conducted. This is the arangement more particularly Seen in the follicles. In the glands the arangement is analagous to that of the mucous follicles, but as in the Stomach & intestines, in the glands they often assume an appearance Similar to a bunch of grapes.

This is the type of all glands which Consist of granules, & in all Convoluted textures. In other Cases the duct is Convoluted & packed together & there is exactly the same arangement as in other Cases. There must be a different endowment possessed by the different cells in order that they may Secrete different materials.

XLIV. **Exhalations or Simple Secretions**

A. Internal
- 1. Areolar
- 2. Serous
  - general
  - vascular
- 3. Synovial
- 4. Adipous
  - fat
  - marrow
- 5. Pigmented
- 6. Capsular

B. External
- 1. Dermic
  - skin
  - mucous membranes
- 2. Menstrual

C. External and Internal Faecous

Secretions are variously divided. There are Simple Secretions, & there are Secretions which are follicular, or cryptal, which require there shall be a union of material in the blood, which shall be brought together & there be discharged by cell agency, & then there

are ales glandular Secretions. Exhalation means the throwing off in a state of vapor. It is usually considered as a fluid which passes from the interior to the exterior without there being any necessity for any special action, or if there is any action at all it is of a very slight character. An areolar Secretion takes place in the areolar tissue & Consists essentially of the Serum of the blood. There is an exhalation which takes place from all the Serous membranes of the body.

XLV. In the case of adipous secretion there are particular cells which draw out into their interior, the fatty matters from the blood. Where the fat exists it seems to act as a cushion on which the parts may rest. It is a reservoir to Serve the wants of the economy, which when it is in want of it, takes it up again for its use. The pigmental Secretion must be accomplished by cell agency. The pigment consists of carbonaceous matter which Can be found in the blood. The Capsular Secretions are similar to the Serous Secretions, as they are formed generally in Shut Sacs, & also in Cells which have no excretory ducts. There is an external Secretion or exhalation taking place from every part of the Surface of the body which

forms about 1/8 of the matter of exhalation, & this amount may always be increased by an increase of temperature

XLVI. In many cases of tympanitis & other diseases there is a secretion of air taking place. This is merely a simple act of exhalation passing out by Endosmose, & the fluid is accumulated in the intestinal Canal, or other parts of the body according to the nature of the disease

II. Follicular Secretions

1. Of the mucous membranes { Gastro pulmonary / Gastro urinary

2. Of the skin { a. Sebaceous / b. Meibomian / c. Ceruminous / d. Preputial / e. Odoriferous

3. Of the Ovaries

The follicular secretions are much the same as the glandular secretions. In the follicular secretions there is nothing of the secreted matter to be found existing first in the blood; & therefore Cell agency must be necessary here, & the substance brought from the

blood by the vital force & brought together to form by an act of Chemistry the proper secreted fluid. The simplest form of mucous membrane is like the Serous membrane, Consisting of a layer of cells, a basement membrane with the blood vessels. The depression of a mucous membrane constitutes a follicle no matter what maybe the shape it may assume. It is therefore probable that mucus may be formed on the free Surface of a mucous membrane, as well as in the follicle or depression, but wherever met with there must be a layer of epithelial cells & there must be blood distributed to the cells & there maybe a basement membrane. The mucus is not always identical. It is a viscid Substance, insoluble in water & appearing to Consist of Something like globules when examined under a microscope, & wherever met with, appears to be poured out on the free Surface of the mucous membrane simply to lubricate it & allow materials passing from the interior to the exterior readily to reach the exterior & then be discharged. Where the waving Cilia exist, the mucus given out by the free Surface of the mucous membrane is Carried along by the cilia which wave perpetually towards the outlet; & if a portion of mucus gets in Contact with one of these Cilia, the mucus passes from the top of one to the top of another & the passage of the material to the exterior of the body is thus facilitated.

all the mucous Secretions are either gastro-pulmonary, or genito-urinary; as the mucous membranes are essentially alike in character, in morphology, & in physiology, & to a certain extent alike in their pathology, & they are merely continuations of the external membrane. The Secretions taking place from the skin are very similar to the mucous secretions for there is a continuation of the exterior surface of the body, down into the Sebaceous follicles. The Sebaceous follicles are not always seen in a state of health, but the shining appearance on the part indicates where they are; they contain a kind of Stearine of glycerine, which sometimes accumulates there, so that the follicles become distended, & the substance secreted is altered in its character & very often the opening of the follicles become stopped. This gives rise to various forms of acne. They become inflamed in affections of the Eyes & in other affections. The peculiar Secretion of the Meibomian follicles of the eye, as well as the regular Cerumen Secretion of the ears, is essentially the same, except that the latter has a certain amount of resinous matter, which the other does not contain. The Cerumen sometimes accumulates to a great extent, & this may produce some degree of deafness.

XLVII. There are odoriferous Secretions which take place in different parts of the body, and they are follicular in their character

It has been thought by many that there was not much difference between the sudoriferous & the sudoriferous glands. There is a follicular Secretion which takes place in the Ovary which has only a temporary Secretory duct. The follicle of La Graaph is a crypt having no opening into it. There are also Glandular Secretions

III. Glandular Secretions

1. Of the skin
2. Of the lachrymal glands.
3. Of the Salivary glands
4. Of the Pancreas
5. Of the Liver
6. Of the Kidneys
7. Of the Testes
8. Of the Mammæ

A Gland is Considered a Congries of follicles all united together & having an Excretory duct. There are sudoriferous glands which Carry off the perspiration of the skin. They are Exceedingly numerous & very small. Each one Consists of a Convoluted tube having a separate Excretory duct, & this is the only manner in which it differs from the ceruminous

follicles. This secretion is called perspiration, and according as the exhalation is perceptible or not it is called insensible or sensible perspiration, but there does not seem to be much difference between them, except, when a person is not engaged in anything the perspiration will evaporate the not seen & when he is heated it will accumulate on the skin. These convoluted tubes exist in the areolar tissue passing upwards, generally in a kind of spiral manner, so that the opening will be obliquely under one of the scales of the epidermis. The fluid is evaporated either by exhalation or by cell agency. This has been called the Cutaneous depuration by which a great amount of fluid is got rid of, & nitrogen is thus got rid of by the skin. There is also a urinary depuration by which certain portions of the blood & also nitrogen is got rid of. It is not pernicious to check perspiration.

There is a lachrymal secretion by a gland at the upper & outer portion of the orbit. It is a granular gland having several excretory ducts all opening upon the conjunctiva which is a mucous membrane & a sort of extension to the Schneiderian membrane of the nose. The tears are secreted by means of cells from blood sent to the gland & then the fluid comes over the tunica conjunctiva & pass in towards the inner Canthus of the eye where there are two little openings, which are the openings

of the puncta lachrymalia which are the commencement of the lachrymal ducts which go together to the lachrymal bone where there is the commencement of the ductus ad nasum. If there is any closure of these ducts by which the tears cannot get into the ductus ad nasum, they come over the eyelid & this is called Epiphora. These tears are very largely watery, & they get some mucous from the conjunctiva of the eye, & they obtain some humor which is secreted & are discharged as the mixed tears.

XLVIII. The secretions coming from the salivary gland, come from glandular bodies having ducts communicating with them. They have epithelial cells, & blood vessels distributed to them, having the power of drawing from the blood, the materials necessary for the formation of the saliva. A fluid is poured out from the Pancreas into the Duodenum to be mixed with the alimentary matter placed there. Iris like the salivary gland, a granular gland, very essentially resembling the salivary gland in its character. An important function of the fluid is to emulsify any oleaginous matter which may exist in the small intestine, in connection with an admixture of the bile and the intestinal juice. This fluid will convert Starch into dextrine & into Starch Sugar, & the only perceptible difference, on chemical examin-

nation, between it & the fluid secreted by the Salivary glands, is that the latter contains some Sulpho-cyanite of potash which the fluid of the kanuras does not contain. The greatest glandular organ in the body is the Liver which is essentially granular in its character & is not formed of convoluted tubes. It receives two kinds of blood, arterial blood from the arteries, a large quantity of venous blood from the great Vena porta. It is a great assimilating organ through which every substance has to pass before it gets into the blood. The hepatic artery not only goes to the nourishment of the liver, but it also furnishes the materials for the biliary secretions.

XLIX. There is not a great quantity of bile secreted. The bile passes down the ducts to the hepatic duct & passes along to the ductus communis Choledocus & passes to the duodenum. It gets into the Cystic duct & regurgitates into the interior of the gall bladder where it remains until there is some use for it. When it is wanted it leaves the gall bladder & proceeds to the duodenum. The liver has the power of forming sugar which is received in the blood, in the veins which leave the liver. In this it resembles the vascular gland which have no excretory duct. The secretions of the liver do not depend upon the nervous System, although the nervous System may have some effect upon

them. But little of the secretion of the liver is excrementitious.
There is a secretion from the kidney which is entirely excrementitious.
The kidney is placed to get rid of the watery portions of the blood, that
are not got rid of by the skin, & by the lungs, nitrogen as well as
some other substances are got rid of. The fluid secreted & carried away
is called the urine & it consists of a great variety of substances. The
kidney is supplied with an immense number of blood vessels &
ducts. It has an excretory duct called the ureter. The urine is
secreted in the cortical portion of the kidney.

L. The specific gravity of urine varies at different periods
The urine consists mainly of water as seen below

Urine (Bequerel)

Water	967.
Urea	14.230
Uric acid	.468
Coloring matter, mucus & extractive, inseparable	10.167
Sulphates of Soda & Potassa	

(carried forward)

Biphosphates of lime, Soda Magnesia & Ammonia. Chlorides of Sodium & Potapium Hippurate of Soda Fluoride of potaprium	8.135
Silica	Traces
Total	1000.000

After the urine has been Secreted in the kidney, it passes to the interior of the bladder by the ureter & passes out by the urethra.

LI. There is a glandular Secretion Coming from the testes which consist of Convoluted tubes bound together, every portion of the tube Communicating with the other portions, & having Each an Excretory duct Called the vas deferens. The testes Exist originally in the abdomen in the neighborhood of the kidney & about the 7th month of uterogestation they pass down into the Scrotum. The fluid Called Sperm is Secreted both from the testes & from the vasa deferentia; & in the fluid Secreted there is a material which seems to be like an animalcule, but which is nothing but Something Similar to the vibratile Cilia visible in all Mucous membranes

They are formed by cell formation. There is a fluid secreted from the mammæ which is admirably fitted for the sustenance of the animal just born. The gland is racimose in its character Consisting of a number of lobes, & these lobes have secreting cells in their tubes & have blood vessels distributed to these cells. They are furnished with lactiferous ducts which Come together until they form a number of sinuses which Congregate at the nipple & open upon its surface.

LII. There is a smaller gland like the mammæ in the female found in the male Called the mamilla, which is subject to be- Come much larger, & even become so developed in some cases as to af- ford the same kind of secretion as the female organ secretes. The milk will be secreted for a long time if the female Continues to Suckle her child, but the longer it is Continued the less nutritive it becomes, & it differs somewhat in appearance to what it did at first. When the restoration of the menses appear or the woman becomes pregnant during lactation, the milk will become much impaired in quality. The new milk Contains some oleaginous matter, which is well adapted to the Evacuation of the Meco-

cum of the newborn child.

LIII The morphology of the Splenn is very obscure. It is thought by many that the Splenal blood is distributed through the liver in order that changes may be effected upon it & to form red Corpuscles. In certain Cases it is capable of great distension, & it may be that it serves as a diverticulum. When the Splenn is removed from an animal, the animal does not die, but seems to grow fatter & therefore it does not seem to be very important. Other glands seem to be placed in the same Category as the thymus gland, & the thyroid gland & other ductless glands. It has been lately thought that the Supra renal Capsules, tend to form a bronzed appearance in the individual. The ductless glands are concerned in the Sanguinification of the blood. Another functions of nutrition is the function of Calorification by which animal heat is produced; but it applies equally to the vegitable with the animal, & the nerves are not necessary for the performance of the function. The heat is produced over every part of the Economy but varies in degree. There is heat given off where Carbonic ~~acid~~ comes in contact with Oxygen forming Carbonic acid, but there are many other ways in which it may be produced as when

hydrogen & oxygen unite to form water. Wherever Sulphuric or phosphoric acid are formed, there will be more or less heat elicited as well as the amount of friction occurring in different parts of the economy, & when there is a change from the fluid to the Solid state. The blood is generally considered to be of the temperature 98°, but it is nearer 102° or 102½° & this maybe the general temperature of the body, but certain portions of the body are at times much higher in their temperature. The animal heat is not formed in the lungs & distributed by the arteries ~~& veins~~ to the tissues, but it occurs wherever there are any changes going on in the System of nutrition. There is in the Economy a power of increasing heat to overcome depressed temperature, & there is also a faculty of sustaining immense temperatures at times, as 260° 300° & even over 400°

LIV. There are some functions which belong to the animal alone & they are Called Animal functions. Nervine or nervous matter forms the nerves which Communicate to the great nervous Centres, as well as the great nervous centres themselves. The nervine lying within the Scull & vertebral Canal can be approached by any External object.

LV. There is a tubular & a vesicular nervine. It is supposed that the nerve power is produced by the vesicular nervine at the periphery of the brain & passes down the tubular nervine to the various muscles & tissues. In certain portions of the nervous Centres, there is a little tubular matter mixed with the vesicular matter. The great Cerebro Spinal System presides over the different acts of Consciousness Executed by man. The nervous Centres Contained in the Spinal marrow presides over the involuntary functions. There are two roots which go to the formation of every Spinal nerve, one of which is a root of motion, & the other is a root of Sensation. The Sympathetic nervous System is Considered by many as a Separate System, & others think it is formed by ramifications from the Spinal marrow, & by Some as Communicating with the cerebral nerves. Ramifications of this System are found everywhere, distributed to the blood vessels &c. It is the organ of the nervous System which communicates all the different trunks with Each other.

LVI. The nervous trunks require that blood Shall be distributed to them & 1/8 blood in the body is sent to the interior of the head. A number of vessels arise at the base of the brain, & during

the contraction of the heart, there may be a pulsation given to the brain. There are also movements of the brain Synchronous with respiration. It is thought that the innervation is effected by Something galvanoid in its character. The animal functions are; Sensations; intellectual & moral Sensation; movements & movements of & respiration. Sensations put us in Contact with bodies around us. Sensation is the expression of an irritation of Some kind, & they may be general or Special. Touch is one of the expressions of general Sensation. The posterior roots of the Spinal nerves are Connected with general Sensibility as well as the nerves of the 5th pair & Some others.

LVII. The organ of perception must be in a state of integrity that its functions may be properly accomplished. The brain itself, may under Some circumstances Engender Sensations. forming Subjective Sensations as contrasted with objective Sensations. There are 5 Senses, viz, Touch; taste; Smell; hearing; & Sight; which may all be regarded as one Sense, or modifications of the Sense of touch. the geometrical Sense. The chief organ of touch is the upper extremity of man. The Sensitive Surface is the derma or true skin lying under the cuticle & to which the blood

vessels & nerves are distributed. It is the sense by which we become acquainted with bodies external to us, & by which we judge of temperature, the most accurate of all the senses. It can only judge of bodies immediately in contact with it. In right handed persons, the left hand is more susceptible of appreciating heat than the right. This sense can be cultivated by education to an incredible extent.

LVIII. The most perfect instrument of touch is the extremity of the middle finger. Different portions of the skin, differ much in their power of appreciating impressions. The sense of touch is an intellectual sense. The sense of gustation resembles much the sense of touch, but there must be a savor in the article which must be mixed with the mucus in the mouth & come in contact with the nerves of taste. The organ of taste is the tongue, & the mucous membrane of the tongue. There are other nerves distributed to the tongue. There are the 9th pair originating from the anterior column of the spinal marrow, & it is the nerve of motion to the tongue. There is also a large branch of the 5th pair of nerves, the lingual branch & this is a nerve of sensation & of general sensibility. There is also another nerve, the glosso-pharyngeal originating from the spinal marrow along with the pneumogastric nerve, which is the nerve of special

Sensibility, or of taste. It reaches the tongue about the root of the organ, but, it can be traced on towards the tip of the tongue. This is one of the Corporeal Senses.

The particular nerve concerned in the sensation of smell is the olfactory nerve, while the nerve of general sensibility is the 5th pair distributed to the Schneiderian membrane. The olfactory nerve is distributed only to the upper part of the nasal fossa + to the turbinated bone. The odorous particles of a substance come in contact with the Schneiderian membrane, + thus the sense of smell is experienced. If the olfactory nerve is very largely developed, it does not follow that the animal should have a greater sense of smell. This sense is a Corporeal sense, but is capable of being subordinate to intellection in some cases, + it is capable of being educated.

The sense of audition is an intellectual

sense, & its operation is due to the vibrations produced by bodies, & also by the vibrations or resonance. The organ is the Ear. The Ear may be divided into the External middle & the internal, on the latter of which is distributed the auditory nerve. The External ear is adapted by the Expanded Extremity, the Concha, for the reception of many Sonorous vibrations, which are Conveyed along the Meatus Auditorius, until they get to the membrana tympani, which is the inner closure of the External Ear. —

The Sonorous vibrations are propagated from the membrana tympani along the tympanum to the internal Ear, where there is a chain of bones which Communicate the vibrations to the membrane of the fenestra ovale. The internal Ear has the auditory nerve distributed to it & it only; & the parts in walls of the Ear

proceeds along the meatus externus to the bottom of it. within the osseous labaryuth there is a membranous labaryuth, from which it is separated by the liquor of Cotunnius. The vibrations are communicated to the labaryuth to the membranous labaryuth, to the Endolymph within, & in this all the ramifications of the auditory nerve are distributed. When the impression is made on the auditory nerve, it proceeds to the origin of the nerve, & the brain appreciated the different vibrations & the difference is recorded. This is the sense which gives us a knowledge of Spoken language; & therefore the person deaf from birth must remain dumb. It is the sense by which we appreciate music, & many other things It will give us an opinion of the size of apartments, of the amount of bodies & of their size.

The organ of vision is the Eye, the most perfectly formed instrument of which we can have any conception. –

The ray of light passes through the Cornea & the three humors until it impinges upon the retina. The aqueous humor is less dense than the Crystalline, & the Crystalline is less dense than the vitreous humor, & therefore the rays set to a focus upon the retina. The Crystalline humor has a peculiar arangement for it is so formed as to Consist of media of different densities, the dispersing power of one being overcome by another, & so on, so that an impression is made upon the retina entirely devoid of color. The iris prevents the rays of light from impinging on the very margin of the lens which is denser in the Centre than it is on the edge. Cataract is situated in the Crystalline lens or its Capsule severally; & therefore

in Cases of blindness from such Causes, the opaque body must be removed. —

The central portion of the eye is the pupil, & immediately surrounding it, are rays of a Circular kind, Concentric with the pupil, & there are usually muscular fibres situated on the outside, radiate in their character, & occupying the very Centre of the iris. It is the 3rd pair of nerves, which being distributed to the iris gives occasion to its Contraction; & the Cervical branches of the great Sympathetic will dilate the iris. This is the sense which gives us notion of the distance & Size of external bodies, & it is purely an intellectual sense. —

The Brain is the organ which enables us to judge & to reason, & it is therefore necessary that it should be in a proper Condition for the reception of impressions.

the peculiar function resides in the vesicular matter of the brain. In many of the lower animals, after the separation of the head from the body, there are acts of sensation & volition with intellectual acts, performed both by the head & the body; but the organ of all the intellectual acts of man is found in the brain alone.—

There is nothing by which we can discriminate between individuals as to their intellectual power by external signs & characters. We cannot arrive to any practical results as to the intellectual & moral powers of an individual by an external examination of the head without any regard to the physiognomy of the individual.

In the manner in which the muscles are inserted into the bones of the body, there is at times a loss of power; but there are often Compensating Circumstances, such as Extent of motion, & Symmetry in appearance. Generally a lever of the 3rd kind which is the most disadvantageous to power is employed, where the tendon is inserted very near the fulcrum. There are Voluntary & involuntary muscles; but the voluntary muscles are liable at times, to be thrown into involuntary Contractions. The principal muscles are those employed in Voice which is produced by a kind of muscular Contraction Conjoined to the production of Sound.

Every living body comes from a primary cell which is furnished by the two sexes. In order that an ovum shall become fecundated, it must be penetrated by the Spermatozoid of the male sperm.

Surgery Continued from Tome II fol 400

In some Cases a medicated bougie may be introduced twice or thrice in the 24 hours. Then treat the patient as under other Circumstances. The patient may go into the open air, make use of the Cold douche, Shower bath &c.

Gonorrhœa occasionally occurs in the female, & it seldom involves the entire extent of the mucous membrane of the urethra. The Symptoms are much the Same as those in the male, but there is generally Comparatively very little pain. The treatment is very Simple. Confine the patient to the recumbent position. In the Early Stages, make use of Some mildly astringent injections; Acetate of Lead, or Alum, & water, Camine & a little muriate of Soda,

with a large Syringe, used 6 or 8 times a day. In the intervals, Cloths wrung out of warm water, or even cold water, may be kept upon the Vulva, keeping the labia separated. Purge the patient. If the inflammation is severe, give Antimonette & Epsom Salts. Generally it is not necessary to bleed.

After the inflammation has been moderated, make use of strong astringent lotions or injections as Alumina Sulphatis ℥ij to a quart of water, & some Saturn lead or Goulard's Extract, applied by means of a roller of patent lint, about the shape & length of the vagina, saturated with the medicated lotion, & the patient should be directed to introduce it as high up as possible. Leeches will sometimes be of service; & sometimes, if there is much in-

Ammonation, a little nitrate of Silver, in the Solid form, may be applied to the inflamed Surface.

Primary Syphilis.

This Consists in a Chancre or ulcer upon the head of the penis, or upon the prepuce; or, a bubo, a Swelling in one or more of the lymphatic ganglia of the groin. This usually manifests itself within 4 or 5 days after an impure Connexion; bubo within a period varying from 8 to 12 & 15 days & even three weeks.

Secondary Syphilis usually manifests itself at a period of from 4 to 6 weeks, & tertiary Syphilis at a period varying from 6 to 18 months.

Primary Syphilis is an inoculable affection. The matter of Chancre, or the

matter of bubo will produce the same affection. Secondary & tertiary Syphilis are not transmissable by inoculation; but secondary Symptoms may be Communicated by the mother to the child in the womb, & perhaps by the father to the mother, & the offspring during a fruitful Copulation. During lactation, the disease may be Communicated from the nurse to the child. The tertiary form is not inoculable, nor transmisable in this form; but the offspring of parents thus affected, are liable to suffer from debility, Cachexia, Scrofula, tuberculous & other diseases.

Chancre presents itself in the first instance, either in the form of a little pimple, or in the form of a little ulcer, according as there has, or there has not been an

abrasion of the mucous membrane or skin.
There is a form of Chancre where the parts are indurated, & the ulcer seems to be scooped out, having at the base a quantity of greenish unhealthy pus. It is usually situated on the head of the penis.
There is another form, generally upon the inner portion of the prepuce, onto very margin, & it is not indurated. The indurated Chancre is about the size of a 3or 5ct piece. The other is generally smaller, & is always superficial; but as the disease continues it may become larger. There is discoloration & the parts are soft. The ulcer is of a yellowish or darkish complexion, always devoid of anything like granules; but after the lapse of some time it may become gradually covered with

granules, & ultimately, little tubes.
The secretion of the indurated chancre, is of a thin sanious character.
These varieties of chancre are liable to be complicated on account of the occurrence of severe inflammation, dependant upon local or constitutional causes. This idea may be modified by the violence of the inflammation.
If a patient comes a few days after connexion, with a slight abrasion on the mucous surface, apply nitrate of silver to the part; or the best thing is the acid nitrate of Mercury applied carefully to the part. Or remove it with the knife or scissors to get rid of it at once, & then treat the case the same as any other affection of a simple character. If it has reached

a certain stage of maturity, Cauterization & excision, will be greatly improper; & then the part must be treated locally, & the System, Constitutionally. Whether the Chancre is indurated, or non-indurated, the treatment is the same, & by the mildest means Especially in the more simple forms of the affection. Take a lotion of Zinci Acetatis, and Zinci Sulphas 8 grs along with a certain quantity of Opium or Laudanum, & keep this in Contact with the affected part, changing the lint frequently; & bathe the part 3 or 4 times a day with tepid water, Containing a little Salt of a metal as Chloride of Sodium; or Employ a very weak Solution of Sulphate of Copper or of Tannin & of Opium— ℞ Cupri Sulphas, 2 or 3 grs of Tannin & of

Opium, to the oz of water, & apply this by means of a little patent lint to the affected Surface, changing it 6 or nine times in the 24 hours. The application must be varied if one is found irritant or obnoxious. If there is much tumefaction of the penis, make use of the warm water dressings, simple or medicated, or of an emollient poultice which should not be too heavy. Keep the parts well suspended; purge the patient at least once every other day, acting promptly upon the bowels; Starve the patient, give him antimonials; & if he is strong, take blood from the arm, & by leeches from the perineum, or from the inner Surface of the thighs, but not too near the Seat of the Chancre, lest there be inoculation from the bites of the leeches.

If there is phimosis, do not slit open the prepuce, but make use of the Syringe. Inject medicated lotions under the prepuce a number of times in the 24 hours.

When the chancre has a tendency to spread in every direction, or is in a state approaching to mortification, if the pulse is feeble, the symptoms are typhoid, give quinine, with or without iron, & Carbonate of Ammonia; Spirituous drinks, nutritious diet; large quantities of anodynes to allay pain & induce sleep, & to tranquilize the action of the heart. If the patient is plethoric, & there is an ulcer surrounded with Sanguine, bleed him locally, or from the arm; purge him; give antimonials; restrict him in his diet &c. In none of these cases must Mercury be Employed.

Occasionally the disease has a tendency to linger, & then a little Calomel, a blue mass, or other preparation of Mercury may be given once or twice in the 24 hours; merely to touch the gums, keeping them tender for several weeks, until the indimation has disappeared & the poison has become eliminated from the part.

A **Bubo** is a swelling in the groin produced by disease of one or more of the lymphatic ganglia in Consequence of absorption of the Syphilitic poison. This may take place within 8 or 10 days after the ocurrence of Chancre, or not until after 3 or 4 weeks. As long as the Chancre is not more or less indurated, there is little or no danger of this Contamination.

Generally there is but one gland affected,

or at most two or three; & the structures affected are situated just above Poupart's ligament. When it is below Poupart's ligament, & there are a number involved, it may be Sympathetic bubo. The patient should be treated antiphlogistically. Apply to the parts twice a day Ł Sodiumm in its pure State; & in the mean time make use of warm water dressings or Emollient poultices; keeping the limb in a flexed position; & in a few days, the Swelling may disappear. If the disease has made more progress, the part may be blistered to an extent about the Size of a 25ct piece; or a Solution Containing 20grs Bichloride of Mercury to the Ozfl water, may be applied; & apply this after the removal of the blister, & keep it there by a bandage for an hour or two; & then dress

the part with an emollient poultice, or the warm water dressing, & treat the case upon general principles. The iodine may be employed along with systematic Compression. If this tumor is advancing to Suppuration, make an early & free incision. If Sinuses form afterwards, they must be laid open in the usual way, & if the skin has been extensively detached, it must be removed. If the bubo is indurated & slow in healing, mercury may be given with great care.

Secondary Syphilis manifests itself in the form of Eruptions; inflammation & ulceration of the throat, & various affections of the hairy Scalp & of the Eyebrows. There is usually an exanthematous form of the disease, presenting itself in the form of Copper Colored blotches, from

the size of a split pea, to that of 2 inches in diameter, & they may extend from the Crown of the head to the Sole of the foot, or only over a Small Space. There is a feeling of uneasiness in the bones & back; restlessness at night; Vitiated appetite; more or less febrile motion &c; & there is the Scaly form of broad Specs, on the palms of the hand & Soles of the feet, liable to occur also on the forehead & other parts of the body. There is the Vesicular form, an Exceedingly rare variety in the form of little vesicles from the Size of a pea, to that of a 25 ct piece. There is the pustular form, where numerous pustules appear on different parts of the body, Containing pus. There is the papular, & the tubercular form of disease liable to occur

in Consequence of this Contaminated State of the System.

The treatment should be with tartarmetic, purgatives, & low diet. It is not necessary to resort to mercury except in those Cases which are exceedingly obstinate. The treatment should be addapted to a proper regulation of the patients diet, & to the administration of tartarmetic, given in minute doses several times in the 24 hours, & in this way most of these affections will promptly yield. When they are obstinate, the patients gums may be kept tender for several weeks. When there is inflammation of the throat, followed or not followed by ulceration; treat this upon the same general principles. Apply the Nitrate of Silver, a weak Solution of iodine;

astringent washes; & in this way get rid of the inflammation. If ulceration takes place, the ulcers are excavated in their appearance & the surrounding surface is of a coppery color. Here, resort to local applications; Nitrate of mercury, nitrate of silver, Sulphate of Copper; & such articles, the best of which is the Acid Nitrate of Mercury. Refrain from the internal use of mercury unless it be absolutely necessary. If the patient is feeble, give tonics; & the acids especially, dilute Nitric acid; give nutritious diet, & supporting drinks. If the reverse be the case, make use of depletory remedies, as in a case of ordinary inflammation.

Tertiary Syphilis manifests itself in from 6 to 8 months after

the commence of Chance, in the form of Swellings or nodes upon the most exposed portions of the skeleton; on the tibia; on the fibula; along the clavicle &c & in the bones of the Skull. There is also inflammation of the superficial portions of the osseous tissue, & fibrous covering of the periosteum; going on sometimes to suppuration of an imperfect character, or to the formation of a sac of gelatinous lymph. Sometimes the testicles become affected. There may be very serious ulcers upon the skin. These sores may last for months & even for years. The treatment consists in giving the iodide of potassium, which is the great remedy; in doses varying from 10 to 30 grains, given 3 times in the

24 hours; either alone, or in Combination with other articles. The treatment must be varied according to Circumstances. This is the great remedy in all forms of Tertiary Syphilis however manifesting itself —

pearly globule. Fusible Calculus is a mixture of the 2d & 3d Kinds. It melts readily. The facture is ragged & uneven. It is brittle as Chalk. It is very Common & often attains a large size. When its powder is acted only Cold acetic acid, tribasic phosphate of magnesia & Ammonia is dissolved as before Oxalate of Lime Calculus is hard & Compact with a dark tuberculated Surface. When placed before the blow pipe an alkaline Substance is left. No Chemical remedies are known which will Counteract its deposit. There is an alternating Calculus, and a mixed Calculus, Composed of the different Constituents mixed up.

Hydrochloric acid, Uric acid is precipitated. It forms in layers around a central nucleus & it is the most Common form of Calculus. Phosphate of Lime Calculus (Bone earth Calculus) has a pale brown Surface, quite Smooth, polished & shiny laminated, in layers easily separated in Concentric Crust. It dissolves in dilute Chlorohydric acid. It is insoluble in potassa. Under the blow pipe, it becomes first black, then white, but does not melt unless the heat is intense. Phosphate of Ammonia & Magnesia Calculus rarely Exists alone. It is generally white & less Compact than others. In powder it dissolves in Cold acetic acid, & the basic acid is precipitated unchanged by a Solution of ammonia. By a Solution of potassa, Ammonia is set free & potassa takes its place. The formula of this Calculus is $NH_4O, 2MgO, PO_5 + 12HO$. Before the blow pipe it diminishes & melts into a white

crystalline, usually amorphous. Phosphatic deposits are of a lighter red Color & are generally crystalline. If the tendency to form deposits be not checked, a granule is formed in the bladder or passes from the kidney & increasing in size from accretions forms the foundation for stone. There are only five practically important Species of urinary Calculi. 1st Uric acid, 2nd. Phosphate of Lime 3rd. Tribasic phosphate of magnesia & ammonia 4th. Fusible Calculus, 5th. Oxalate of Lime, otherwise Called mulberry Calculus. There are other rare Calculi, such as Cystic oxide Calculus Containing Sulphur. Xanthic oxide Calculus and the fibrinous Calculus. Uric acid Calculus is of a brown Color, hard & flat, and oval in form. The Surface is generally Smooth. In a Solution of Caustic potassa it dissolves, and by adding

their resemblance to Chalk. In many diseases, the urine is altered in quality & quantity. In Diabetes, it Contains Glucose, when the urine is in great quantity, Sp. gr. often being 1040 or 1050. The proportion of Urea is diminished. In dropsy the urine is deficient in quantity and the Sp. gr. is low, varying from 1005 to 1015. It Contains little urea, but generally a proportion of albumen.

In morbid Conditions of the urine there is a tendency to deposits. In one state uric acid is deposited, & in another phosphatic Salts are thrown down. These diatheses if not Corrected, will Sooner or later lay the foundation for gravel or Stone. The remedies are, when the Sediment is uric acid, the fixed alkalies. Soda, potassa, lithia, given as Carbonates or Bicarbonates. When phosphates are deposited, acids are the appropriate remedies. The uric acid deposit is yellowish red, Sometimes

which is the organic characteristic ingredient of the urine which undergoes a change. Healthy urine Contains the Constituents seen in the table on the opposite page. Urea has a saline taste like nitre. At 120° it melts, and at a higher temperature it is decomposed. It is Soluble in 5 parts Cold and 1 part boiling alcohol. It is freely Soluble in water. When pure, a Solution of urea does not undergo any Change. If there is an impurity it will quickly ferment, Converting Urea, with elements of HO to Monocarbonate of ammonia. Uric acid Exists in the urine of all Carniverous animals. In birds & reptiles it is voided with the Excrement So Concentrated as to form a white Solid mass. In disease, Uric acid is often Secreted in Excess. When united with Nad as Binate of Soda it forms the gouty Concretions absurdly Called Chalkstones from

LXXII. **Urine** (Berzelius)

Urine	Uric acid ($N_2C_5HO_2+HO$)	1
	Lactic acid, lactate of NH_4O + Extract	17
	Salts and mucus	19
	Urea ($N_2C_2H_4O_2$)	30
	Water	933
		1000

Salts in Urine	Sulphates	KO and NaO
	Phosphates	NaO, Am, CaO, CO_2 MgO

Urine is an amber colored liquid Sp. gr. 1020. It is apt to undergo decomposition. At first when healthy, it has active reactions; but by keeping, ammonia is generated and it becomes alkaline, letting fall a white sediment which consists of tribasic phosphates of Lime & other salts. The source of the ammonia is Urea

is the coloring principle and exist Coagulated and uncoagulated. In the latter Case it is associated with globulin, and Can be evaporated at a temperature which must be less than 120°, for at a temperature of 120° it is made Coagulable. It may be Separated in either state. In the Coagulated state it is a dark brown mass, tasteless, and inodorous. It Contains 6 % of metallic iron as an essential part of its Constitution It forms 4% of the matter Composing the red Corpuscles.

There Exist gases in the blood. Oxygen, Nitrogen and Carbonic Acid.

There are four pathological states of the blood 1. Increase of Fibrin. 2. Increase of red corpuscles. 3. Great diminution of Corpuscles. 4. Diminution of albumen in the Serum.

left undissolved. Fire destroys the animal matter and leaves the salts. The enamel of the teeth Contains only from 2 to 3% animal matter. Shells are principally Carbonate of Lime, with some animal matter. Blood. Sp. gr. 1046 to 1065. in higher animals. Crassamentum = red Corpuscles, and Fibrin. The red Corpuscles are Contained in the fibrin by its Coagulation, though they have a tendency to fall, & they Color the Clot. If the Coagulation of the fibrin be slow, the Corpuscles subside, & the surface is of a pale yellow Color & is Called the buffy Coat. Serum has a mawkish, saline taste. It is Composed of water 90% albumen, & less than 2% salts, fat, & extractive matter held in Solution. The red Corpuscles are minute flattened discs, elliptical in other animals than the mammalia. They Consist of globulin & hematozin Globulin is insoluble in a dilute saline Solution, but in other respects is the same as albumen. Hæmatozin

Cerebric acid is a white powder like starch, which on Cooling, is deposited from boiling alcohol, which has been acting on a portion of the brain.

Oleophosphoric acid is a liquid fatty acid.

Cholesterine is obtained from Certain Gall Stones. It exists in the bile. It is in large quantities in the Brain. It is insoluble in water, but soluble in hot alcohol. Nos Convert it into Cholesteric acid. Cholesterine $C_{36} H_{32} O$, forms one variety of fatty tumors of the brain. Cheroline exists in the blood It is an unsaponifiable fat, a white flocculated Substance Various Salts in Small quantities are found in the blood and tissues. The Derma is gelatin. The Epidermis is Coagulated albumen as are hair, nails, tortoise Shells &c. Muscle is Composed of fibrin, water, creatine & Salts. The Brain Contains albumen, water & extractive Salts, besides the three acid fats. By acting on bone with muriatic acid, bone gelatin is

in ether and alcohol. It is dissolved in muriatic or acetic acid, by digestion in a strong solution of nitre where it may be precipitated by alcohol, acids, and the metallic salts.

Fibrin $N_4 C_{36} H_{25} O_{10} + 2HO$ - S and P. also CaO, PO_5 traces

Casein is found in the Curd of the milk of mammalia

Casein $N_4 C_{36} H_{25} O_{11} + 2HO$ - S, CaO, PO_5 and KO traces

When these three are dissolved in a solution of Caustic potassa & otherwise digested in acetic acid, all traces are held in solution & the N6, H, & O is precipitated. Fibrin, Casein, & Albumen all produce the same precipitate Called Protein $N_4 C_{36} H_{25} O_{10}$

150 parts of Bone contain

Bone Gelatin	50	Bone phosphate of Lime (3 eq)	87
Earthy & Alkaline Salts	100	Carbonate of Lime (MgO, CO_2)	10
		Carbonate of Soda	3

There exist some fatty matters exclusively animal Cholesterin & the two phosphuretted fats of the Brain

uniting with the Calomel and the chlorine in ten different Combinations. It is an antidote to many poisonous metallic salts. Coagulated Albumen is obtained by heating a Solution of albumen to a temperature between 140° and 150° when it suddenly takes on a Solid state. This is somewhat sticky & elastic, and by gradual heat it may be got dry, Capable of being broken. It is a dry yellow transparent substance insoluble in water. Albumen = $N_4 C_{36} H_{25} O_{10}$ + 2HO { P and S Traces

Fibrin is the basis of muscles & is an important Constituent of the blood. It is best prepared by briskly stirring up freshly drawn blood with a bundle of twigs; wash in water, digest in alcohol & ether, and then dry them & you have pure fibrin. A glass brush may be employed instead of twigs. It forms a yellowish mass insoluble, though it swells in water. Soluble

& as Size by the paper maker. Isinglass is often used as a substitute for making Calf's foot jelly. Chongrin is a substance varying somewhat from Gelatin. It is obtained from those Cartilages in which bone is never deposited, as in the Cartilages of the ribs.

Albuminous Substances include albumen fibrin & Casein & their derivatives. Albumen exists in two states, as Soluble & as Coagulable albumen. Soluble albumen may be obtained by evaporating the Serum of the blood, or white of egg to dryness, the temperature not exceeding 120°. The action of water will slowly dissolve this. The Solution in water is precipitated by alcohol, acids, and metallic salts. With the latter the precipitate is an insoluble Compound of albumen and the metallic oxide of the metallic salt. Albumen acts on a Solution of Corrosive Sublimate,

tremulous jelly. It is variously called according to its source. It is officinal as Ichthyicola or isinglass. Ordinary white glue, & impure yellow glue are gelatin. The sounds of fishes constitute the best kind of gelatin. The sturgeon of Russia, furnishes the Russian isinglass.

Gelatin – $N_8 C_{52} H_{40} O_{20}$ – When Gelatin is digested in SO_3 ammonia is evolved, and Leucine, a white crystalline substance, and a sweet substance, Sugar of Gelatin are formed. They may be separated by repeated Evaporation & Crystallization. Leucine unites with NO_5 forming Nitro-leucic acid, insoluble in ether, soluble in alcohol. Glycocol crystallizes in large crystals. With Tannic acid, Gelatin forms leather, a Combination of animal & vegitable matter. In the operation of tanning, the skin unites with a Considerable amount of Tannic acid. Gelatin is used in the arts as glue,

All the ordinary volatile oils are oxygenous

Resins are obtained from Concrete juices of plants by distillation & are left behind. As a class they are brittle non-Conductors, heavier than water; Soluble in alcohol, insoluble in water. Tincture is precipitated by water. They are Colorless when pure They are easily inflamed. There are acid & neuter resins. The chief resins, are rosin, Copaiba resin, Benzoin, Guiacum, black mastic resin, Copal resin, dragons blood, Scammony &c &c &c

LXXI. There are various proximate principles of animal matters. Gelatinous substances are found in the skin, areolar tissue, muscle, tendon, & bone which Can be boiled to produce a jelly which when evaporated to dryness will give Gelatin. When pure it is Colorless and transparent, sparingly Soluble in Cold, & readily soluble in hot water, insoluble in alcohol or ether. A Solution Containing 1% of gelatin will gelatinize on Cooling, forming a

ether. Treat with Muriatic acid. Oleic acid is liberated and dissolves in the ether which is distilled off. Glycerine was formerly Called the sweet principle of oil. Glycerine is obtained by Saponifying olive oil by litharge when water must be present. It is an oily substance with a remarkably sweet taste. Soaps & plasters are artificial salts of the fatty acids. Soaps are Soluble, and are hard & Soft: plasters are insoluble. Boiling fat or oil with a solution of alkali in excess a Soap is formed. It is however in an impure state. There are two Soaps officinal. Soda Soaps. Sapo - Castile Soap, from olive oil & Soda, and Sapo Vulgaris made from Soda & animal fat, used to make opadeldoc. Plasters are insoluble salts united with mineral oxides. Creasote is officinal & is of an oily nature. Oil of bitter almonds is Hydride of Benzyl & by Exposure to air, it becomes Benzoic Acid.

of soaps & the Glycerine is evolved. The fatty acid obtained added to the Glycerine exceeds the weight of the fat itself owing to some water added to the acid & the Glycerine at the moment of evolution. It may also be obtained by boiling mutton Suet with KO precipitating this with KCl and adding SO_3 to obtain Stearic acid. This is a fine white solid used for making Candles as a substitute for wax & it burns with a clear white flame. This is the Commercial stearic acid. Heat hydrated Stearine with heated NO_5 & other peculiar management will yield Margaric acid. It is fusible at 140°. Dissolved in hot ether or alcohol it deposits in pearly Scales on Cooling. It is a fatty sort of substance. Oleic acid is obtained from oil of almonds. Saponify oil of almonds you form Margarate & Oleate of the fixed alkali. Add a mineral acid & then digest with a salt of lead. Agitate these mixed Salts with

The scales are deposited from a hot alcoholic solution of human fat. Olein exists in most all oils & fats, especially in oil, where it is associated with Stearine or Margarine or both, but in trees. It may be obtained by freezing an oil & then subjecting it to pressure but it also Contains Some Margarine. Olein is liquid. Almond oil is the best specimen of fat Containing a large amount of olein. It is lighter than water, Spgr. .90 to .92. These three substances are Salts Consisting of a fatty acid peculiar to each Combined with a Common base Called Glycerine. The acids are Stearic, Margaric, & Olein acids.

The fats and oils are Converted into Soaps by the alkalies, and it was by observing these phenomena that the properties & Compositions of the oils & fats were discovered. The fatty acids unite with the fixed alkali in the formation of

LXX. Glycerin (Glycerina US) sweet principle of oils $\underbrace{C_6 H_7}_{\text{Glyceryl}} O + HO$.

Stearic acid (St) $C_{68} H_{66} O_5 + 2HO$

Margaric acid (Mr) $C_{18} H_{111} O_4 + 2HO$

Oleic acid (Ol) $C_{114} H_{33} O_3 + HO$

Oil of bitter almonds $\underbrace{C_{14} H_5 O_2}_{\text{Benzyl}}$ $\underbrace{H}_{\text{Benzyl}}$ and $2O$ = Benzoic acid

Benzoic acid $C_{14} H_5 O_2 O + HO$

Oil of turpentine (camphene) $C_{10} H_8 - H + O$ = Resin $C_{10} H_7 O$.

The fat of animals & vegitables Consist of three substances, Stearine, Margarine, and Oleine.

Stearine exists in great abundance in Suet & Tallow. It is formed from Mutton Suet by dissolving it in 10 parts of Ether in a water bath. It is in soft scales, not greasy, insoluble in water, soluble in hot alcohol & hot ether.

At a temperature of 145° Margarine is the principal ingredient in human & goose fat.

acid. There is a double sulphate of ether and water by combination of ether with sulphuric acid. There is a double sulphate of Ether and Ethylin Commonly Called heavy oil of wine, obtained by the action of SO_3 on alcohol with a great excess of SO_3. Treating heavy oil of wine with a weak solution of potassa you form a double sulphate of ether and potassa; and ethylin is thrown out and is Called Etherole or light oil of wine. By keeping this a long time, it deposits crystals isomeric with itself Called Concrete oil of wine. Os ether of alcohol & $\frac{ss}{iii}$ Ethylin from Hoffmans Anodyne. Hyponitrate of Ether is made by distilling nitric acid, or its ingredients, with alcohol. It is a salifiable base. When duly diluted with alcohol & water it forms Sweet Spirits of Nitre. Amylic ether is derived from Amylic alcohol. It Contains Amyl. There is a derivative acid Valerianic acid Containing a Valeryl.

Sulphuric acid, when a reaction takes place, the result of which is the formation of Ethylic ether. Chloroform is made by distilling parts of Chloride of Lime with parts of alcohol, and 6 parts of water. The matter comes over in two layers, the heavier of which contains the chloroform which is washed with water, then with a solution of potassa & afterwards it is distilled with Chloride of Calcium to get it pure. Ethylic Ether when made as strong as possible, has Sp. Gr. of .713. at 96° it boils. Afterwards it is a gas with Sp. gr. of 2.58. The ether of the pharmacopeias is weaker than .713 being Sp. gr. .750. Ether will take up a small quantity of water. Ethylic ether is $C_4 H_5 O$, oxide of Ethyl. From this, acetic acid may be obtained the same as Formic acid from methylic ether. Acetic acid is $C_4 H_3 O_3$ and $C_4 H_3$ is considered a Compound radical Acetyl. This is the hydrate

2 Eqs of H taken from alcohol & 2 Eqs of O added methylic alcohol is turned into Formic acid. Sugar alcohol treated in the same manner forms acetic acid. Fusel Oil treated Similarly will yield Valerianic acid

LXIX. The Ethers are monohydrates of the iso-Equivalent Carbo-hydrogens, of which the alcohols are bihydrates. Treating methylic alcohol with strong acid, methylic ether is obtained. Formic acid is obtained from methylic ether. Formic acid is $C_2 HO_3$ and the $C_2 H$ is Considered as a Compound radical Called Formyl, & Formic acid is therefore a teroxide of Formyl, and if for the O_3, Cl_3 is substituted, the Substance becomes, terchloride of Formyl, which is Chloroform. Ethylic ether is obtained from Sugar alcohol by taking away 1 Eq of water HO by means of strong SO_3. Distill together two measures of alcohol & one of Strong

which is proved by subjecting Glucose added to dist-
-illed water, to vinous fermentation at a temperature
of between 70° and 80°. The ultimate Composition of
Glucose admits of it being divided into alcohol and
Carbonic acid. Amylic alcohol (starch alcohol)
is often Called Fusel oil, or oil of potatoe spirit
This alcohol is poisonous, and in badly distilled
whiskey gets a detestible smell from the presence of
the Fusel oil which is officinal in the Dublin
pharmacopoeia because out of it Valerianic acid
may be made artificially by reaction with the bichromate
of potassa, and the valerianic acid is used to make
valerianate of Soda & from this other valerianates as
that of Zinc, of protoxide of iron, as Valerianate
of Quinia &c. Cetylic (Spermaceti) alcohol
is frequently Called Ethal. It is of no importance.
It is a Solid alcohol. There are acids derivative of
these alcohols, all formed on a uniform principle

Pharmacopoeia. It is made by adding alcohol of .835 to an equal bulk of distilled water; & it Contains 58% water, while alcohol of .836 Contains 15% water. Alcohol is an important & general solvent. It will dissolve Phosphorus, Sulphur Iodine, & ammonia & the fixed alkalies as Caustic hydrates but not as Carbonates. The organic bases dissolve in alcohol, as do Camphor mannite, and volatile & essential oils, Castor oil and all the resins. It is much used by the Chemist as an analytic agent. It is used to obtain spirits, tinctures, alcoholic extracts, to obtain ether & for various other purposes. It is much used in the arts. When plants undergo vinous fermentation to make alcohol, the sugar in the plant is turned into Glucose, or the juice of the plant Contains originally Glucose. Glucose is divided and is turned into alcohol and Carbonic acid;

but it cannot be made stronger than to have the density of 0.813 at 60° for after this the whole spirit distils over bodily, when distilled per se. At this time the alcohol contains 8% of water & the temperature at which it distils unaltered is 172°. The 8% of water can be got out by mixing with the .813 alcohol, carbonate of potassa & then distilling very gently. The heat drives over a purer spirit in the receiver. By repeated distillations the alcohol may be brought to its maximum strength when it contains no water whatever, having Sp. gr. .795 which is the purest that can be obtained constituting absolute alcohol. There are two strengths of alcohol in the US pharmacopoeia 1st Alcohol. Sp. gr. .835. Corresponding to the rectified spirit of the British pharmacopoeia, and 2nd Alcohol dilutum. Sp. gr. .935, corresponding to the spiritus tenuior of the British

in the formation of alcohol which remains in the juice, and Carbonic acid which passes off in bubbles, as a gas, rendering the juice during the process, very frothy. The ferment should be a nitrogenous substance, either vegitable fibrine or albumen which has already undergone fermentation & which is at the time undergoing some change in itself. The product of such fermentation is called a vinous liquor. All the vinous liquors Contain alcohol which Can best be extracted by distillation as it is more volatile than the water & other substances. By such distillation you get what is Called an ardent spirit. The principal flavoring matter in any ardent spirit is a peculiar volatile oil. If the ardent spirit is again distilled or subjected to rectification it becomes stronger & is Called Spirit of wine. By repeated distillation it may be strengthened

There are several kinds of alcohol, the principal of which, with their Composition are seen in the foregoing table. They are all bi-hydrates. The Carbohydrogens in these articles are four isoequivalent Carbohydrogens. The Dublin pharmacopoeia has included wood alcohol among its officinal Combinations. It is the wood naphtha used by Dr Hastings of London. It is obtained in the destructive distillation of wood, as in obtaining pyroligneous acid. This Crude Substance Contains wood alcohol.

Wine or Sugar (ethylic) alcohol is a much more important substance. It Can be obtained from wine, the fermented juice of rye, apples, & many other substances. It is obtained as a product of the various fermentations. Expose the juice of certain vegitables to a temperature of 70° to 80° and add yeast; a change will take place resulting

LXVII. Some neutr substances Contain only two elements, Carbon & hydrogen. Other sections Contain Carbon, hydrogen & oxygen

L. Carb. hyd. CH_2 -- methylen C_2H_2 - Ethylen C_4H_4 - Oleas C_8H_8 (2)

Naphthene $C_{16}H_{16}$ - Cetetin $C_{32}H_{32}$ - Benzole $C_{12}H_6$ - Paraffin $C_=H_=$

Eupione C_8H_6 - Naphtha $C_{14}H_{13}$ - Naphthalin $C_{20}H_8$ plus $C_{20}H_{12}$ Paranaphtha -

Non Oxygenous Volatile oils C_5H_4 or X

Starch $C_{12}H_{10}O_{10}$ - Gum $C_{12}H_{11}O_{11}$ - Signin $C_{12}H_{10}O_{10}$

Cane Sugar $C_{12}H_{11}O_{11}$

Glucose (grape sugar) $C_{12}H_{12}O_{12}$ Lactin $C_{24}H_{19}O_{19}$

Mannite $C_{11}H_{7}O_{7}$. Glycerin $C_6H_7O_5$ Salacin $C_{42}H_{29}O_{22}$

LXVIII.

Wood alcohol (methylic alcohol) $C_2H_2 + 2HO$ (Pyroxilic Spirit)

Sugar " (ethylic ") $C_4H_4 + 2HO$

Starch " (amylic ") $C_{10}H_{10} + 2HO$ (Fusel oil)

Spermaceti " (cetylic ") $C_{32}H_{32} + 2HO$ (Ethiel)

Glucose $C_{12}H_{12}O_{12}$ = 2 eq alcohol + $(C_4H_4 + 2HO)$ and 4 CO_2 ↑

Urea is the only unimportant artificial organic base. It may be obtained by Evaporating urine to a Syrup & then mixing it with 3 times its bulk of weak nitric acid. Purify this by repeated Solutions & crystallizations. Decompose this by Carbonate of protoxide of lead. Then use alcohol as a Solvent for the Urea. Distill off the alcohol & urea is obtained in brilliant crystals. It is without odor & tastes like Saltpetre. It is Soluble in water & alcohol, slightly so in ether. It forms Salts with acid. Urea may also be obtained artificially.

The general Composition of organic bases is Carbon, Hydrogen, Nitrogen, Oxygen. Two only do not Conform to this rule, namely Conia and Nicotia, which are of an oily nature and Contain no Oxygen.

a good test for its presence is Salt of Sesquioxide of iron. Tersulphate produces a blue Color.
Narcotina is extracted by exhausting opium with ether. It is a white, insipid, inodorous, Crystalline solid. Codea is obtained from opium. It acts on the animal economy differently from morphia. It accelerates the pulse & brings about an agreeable excitation followed after a few hours by depression, nausea & vomiting when given as nitrate. Cinchonia is obtained from pale Peruvian Bark. There is a sulphate of Cinchonia. Quinia is obtained from Peruvian bark. It exists naturally with Kinic acid as does also Cinchonia. Its principal salt is Sulphate which exists in minute needle shaped Crystals. The red bark gives both Cinchonia & Quinia. A test for the latter is warm acetic acid & tincture of Iodine. Another alkali is Quinidia.

with other bases, the other base brought in, takes the place of the water. When Lime is added, the Compound formed is a double Sulphate of ether & lime. This Combination is a Case of Substitution The doubtful acids include all unclassified acids

LXVII. **Urea** $N_2 C_2 H_4 O_2 = NH_3, CyO + HO$

There are many natural & artificial bases. The natural organic bases, are white, heavier than water, and mostly Solid. They are inodorous. They are mostly insoluble or nearly so in water, but soluble in alcohol. All the solutions are precipitated by Tannic acid. With few exceptions, the organic bases are eminently poisonous when free & more so in Saline Combinations.

Morphia exists in opium. It is a white crystallizable Solid with a bitter taste, sparingly soluble in ether. Officinal in Sulphate, muriate & acetate of morphia in U.S. pharmacopoeia

liar organic substance obtained from certain biliary Calculi which form in the Gall Bladder. It is obtained in white scales. When acted upon by Nitric Acid it becomes oxidized and Cholesteric Acid is obtained. Ambreic acid is obtained from Ambrein which forms nearly all of a peculiar Substance Called Amber Grease which is found floating on the Seas in certain Southern latitudes supposed to be a morbid Concretion formed in the Stomach of the Spermaceti whale. It has a peculiar fragrant odor & when treated with nitric acid it is turned into a peculiar acid Called Ambreic Acid. There are many other organic acids devoid of Cyanogen

Inorganico-organic acids are Combinations of inorganic acids with organic Substances. An example is the Sulpho Vinic acid, the double Sulphate of Ether and water. It Can Combine with different bases as Lime &c. When this unites

Cow be allowed to putrefy, benzoic acid will take the place of hippuric acid.

Alantoic acid is extracted from the liquor of the alantois of the fœtal Calf. It Can also be obtained from Uric acid. Aspartic acid, Exists naturally in Asparamid or Asparagin which is a peculiar principle found in Asparagus & the root of marsh mallow. This seems to Consist of ammonia united with a peculiar acid Called Aspartic acid. The asparamid is an aspartate of ammonia. Aspartic acid is in white delicate micaceous crystals of a pearly appearance.

Picric acid is obtained from the action of nitric acid on Silk & other Substances, as well as from Indigo. It has a bitter taste & Crystallizes in yellow Scales. It is also Called Carbazotic acid. Indigotic acid is found in indigo & may be obtained from it by the action of nitric acid. Cholesteric acid is obtained by the reaction of nitric acid on Cholesterine a pecu-

upon it it will present a pink Color. Guano Contains a biurate of ammonia & perhaps an oxalate of ammonia. If purpurate of ammonia is dissolved in a weak solution of Caustic potassa & a weak diluted acid added the purpuric acid will be precipitated. Purpuric acid is a pale yellow crystalline Scaly substance. Hippuric acid exist in Considerable quantity in the urine of certain granivorous animals as the horse, Cow, &c. It crystallizes in opaque 4 Sided prisms, Soluble in 400 parts of water. The urates are generally biurates. Biurate of potassa is Soluble in 500 parts of water. Biurate of Soda is Similar in Constitution with Chalkstones which deposit around the joints of gouty individuals. These Concretions are uric acid Combined with Soda & not Carbonate of Lime. Biurate of Oxide of ammonia is Soluble in 1000 parts of water. In the digestion of Benzoic acid there will be formed hippuric acid, & Conversely, if the urine of the horse or

Uric acid is often Called Lithic acid. It exists naturally in the human urine in the proportion of one pint in 1000 of urine, and is about 1/30 of the Urea found in urine. It exists in Guano. It is found in the urinary Calculi in the human bladder wherever it exists. It forms almost the entire mass of the Solid white excrements of certain Serpents, as the Boa Constrictor. When dissolved by a Solution of Caustic potassa & an excess of muriatic acid is added, Uric acid will be deposited. By repeatedly dissolving it, it will be obtained free from Color as a white Substance but slightly Soluble in water. Uric acid may be detected in the granules discharged at times with the urine and it may be Crystalline or Amorphous, depositing a yellow or a pink Stain on the Side of a white urinary vessel. The test is to add nitric acid to the Suspected matter. If there is uric acid it will present a dark purple appearance. If it be heated and a little ammonia be dropped

Classification of Organic Substances

Classes	Sections	Subsections	
I. Organic acids	1. Carbo-oxygen acids		Nitrogenous acids: Uric, Purpuric, Hippuric, Allantoic, Aspartic, Purric, Indigenic, Cholesteric, Ambreic
	2. Carbohydroxygen acids	1. Non fatty ⓒ 2. Fatty ⓒ	
	3. Nitrogenous acids	1. Containing Cyanogen 2. Devoid of cyanogen	
	4. Inorganico-organic acids		
	5. Doubtful acids		
II Organic bases	1. Natural organic bases		
	2. Artificial organic bases		
III Neuter Substances	1. Carbo-hydrogen neuter Substances		Groups: 1. Alcohol & Ethers; 2. Fatty Substances; 3. Oxidized volatile oils & Resins
	2. Carbo-hydro-oxygen-neuter Substances	1. Carbon & water 2. Carbon water & little hydrogen 3. Carbon, water & much hydrogen	
	3. Nitrogenous neuter Substances		
	4. Doubtful neuter Substances		
IV. Coloring Substances.			

formerly Called Tannin. Acting on Galls with water, keeping it in a pulpy state for 3 or 4 weeks the Tannic acid will be turned into Gallic acid. Both Gallic & Tannic acid are officinal. Acting on Sugar of Lead with Nitric acid, an acid is formed Called Lac lactic or Music acid. It Can also be obtained from Gum. Succillic acid may be obtained from Amber. In opium there is a meconic acid; the morphia exists as meConate of morphia. Meconic acid produces a blood red precipitate with Sulphate of Sesquioxide of iron. Benzoic acid is obtained from Benzoin. It is officinal as acidum Benzoicum & is present in paregoric. Camphoric acid is obtained from Camphor by the action of Nitric acid.

LXV. Tabular view of the Symbols of various Combinations of Cyanogen & their Constituents or Composition

$(Cy = Nb_2) - (Cy_2 = Cyb_2) - (Cfy - FeCy_3) - (Cfdy = 2Fe, Cy_3)$

$CyO - Cy_2O_2 - Cy_3O_3 \rightleftharpoons HCy - HCSy - H_2Cfy - H_3Cfdy$

diluted with water & the filtered Solution Evaporated to a Small buck & left to Crystallize. The product is drained from the mother liquor, redissolved, digested with animal Charcoal & again Concentrated to the crystallizing point. It is a white crystalline acid. Potassæ citras is officinal & Liquor Ammoniæ Citratis is officinal in London pharmacopœia. There is in the US pharmacopœia a Liquor magnesiæ Citratus [citrate of magnesia] Citrate of Sesquioxide of iron is a Soluble & pleasant preparation. There is a citrate of ammonia & Sesquioxide of iron. There is an isomeric acid formed from Sour grapes with Tartaric acid Called Racemic acid. Tannic acid is generally obtained from Galls by the action of washed ether. By filtering washed ether through powdered galls, the ether pair dissolving the coloring matter floats above, and ~~tartaric~~ Tannic acid & water remain below. This was

and there is generated Tartrate of teroxide of antimony and tartrate of potassa; which unite as tartrate of teroxide of antimony & potassa. It forms in crystals & is then powdered. It is soluble in 15 parts of Cold & 3 of boiling water. An aqueous Solution when kept a long time generates some vegitable matters. The vinum antimonii is a Solution of Tartar Emetic in Sherry wine 2gr Tartar emetic to one fluidounce of Sherry wine. Syrupus Scillæ Compositus, (Hive Syrup) Contains 1gr of Tartar emetic among other Compounds in each fluidounce.

Citric Acid is obtained from the juice of lemons by Saturating a solution of lime. The juice is allowed to ferment a short time in order that mucilage & other impurities may Separate and Subside; the clear liquor is then Carefully Saturated with Chalk, which forms, with the citric acid, an insoluble Compound. This is thoroughly washed, decomposed by Sulphuric acid,

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while this is in a moist state it is added to a boiling solution of bitartrate of potassa as long as it will dissolve it. This was formerly called tartarized iron. It crystallizes in dark shining crystals or scales. It is officinal in the US pharmacopoeia This solution is evaporated to the consistence of a syrup in a warm bath & is evaporated on thin plates of glass. It is wholly soluble in water.

Tartrate of antimony & potassa. The teroxide of antimony is used to form this, in combination with Bitartrate of potassa. According to the US pharmacopoeia there is used the oxichloride of antimony (powdered algaroth) which is teroxide, associated with terchloride of antimony. Make a solution of bitartrate of potassa & mix it with an equal weight of the oxichloride of antimony. Boil these in a quantity of water equal to four times the combined weights of these substances for twenty or thirty minutes

Notes on Chemistry

Lectures of Prof Baker

1886-7

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